YPLSF

FINAL REPORT
YAKIMA AGRICULTURAL RESEARCH LABORATORY
HAZARDOUS WASTE SEPTIC SYSTEM REMEDIATION

DRAFT - SUBJECT TO REVISION

JANUARY 13, 1992
Our Project Number 90042

Prepared for

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
6303 Ivy Lane Room 672
Greenbelt, MD 20770

Attention: Ms Lyndia Countee

HONG WEST & ASSOCIATES
P.O. BOX 596, LYNNWOOD, WASHINGTON 98046, (206)774-0106

DRAFT

United States Department of Agriculture
Agricultural Research Service
Pacific West Area
800 Buchanan Street
Albany, California
94710

RECEIVED
JUL 15 1992
SUPERFUND

July 14, 1992

Linda Preity
Region IX, USEPA
1200 Sixth Avenue
Seattle, Washington 98108

RE: FINAL REPORT - YAKIMA AGRICULTURAL RESEARCH LABORATORY SEPTIC SYSTEM

Dear Ms. Preity:

Per your request enclosed please find a copy of the final report draft for Yakima Agricultural Research Laboratory Hazardous Waste Septic System Remediation dated January 13, 1992.

If I can be of any further assistance please don't hesitate to contact me.

Sincerely,

ALVIN HUMPHREY
Area Safety and Health Manager

Enclosure

HONG WEST & ASSOCIATES

• Geotechnical Engineering • Hydrogeology • Materials Testing • Construction Inspection •

January 13, 1992

Lyndia Countee, Chief
Service Contracts Section
U.S.D.A. Agricultural Research Service
6303 Ivy Lane Rm 672
Greenbelt, MD 20770-1433

Re: Submittal of Draft Final Site Report - Yakima Agricultural Research Laboratory

Dear Lyndia:

Attached please find one (1) copy of our Draft Final Site Report for YARL, submitted in partial fulfillment of our contract, number 53-3K06-0-24. As required, five (5) copies have been sent to Alvin Humphrey, your technical representative for this contract. Upon receipt of comments, we will revise and provide a final report within two weeks. Should you have any question, please do not hesitate to contact me.

Sincerely,

HONG WEST & ASSOCIATES

Larry West

Larry West, Project Director
Principal hydrogeologist

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DRAFT FINAL SITE REPORT
YAKIMA AGRICULTURAL RESEARCH LABORATORY
HAZARDOUS WASTE SEPTIC SYSTEM REMEDIATION

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SECTION 0.0 EXECUTIVE SUMMARY

This final Site Report for Yakima Agricultural Research Laboratory (YARL) provides an overview of the recently completed clean closure effort, presents relevant geologic and hydrogeologic data and serves as a synthesis of previously-compiled soil, ground water and environmental information.

0.1 PRE-CLOSURE STATUS

USDA prepared a document entitled *Resource Conservation and Recovery Act Closure Plan, Septic System Used For Disposal of Pesticide Wastes, Yakima Agricultural Research Laboratory, Yakima, Washington* on September 9, 1989. This Closure Plan was submitted in compliance with 40 CFR 265.112. EPA Region X approved the Closure Plan in writing on January 30, 1990. The principal elements of the Plan included removal of the waste disposal structures (septic tank and washdown pad), additional background soil sampling, confirmation soil sampling around the removed structures and completion of ground water monitoring wells and one year of sampling. The Closure Plan formed the basis for Hong West & Associates' contract with USDA to execute the clean closure process. HWA began work on the clean closure project on April 3, 1990 and submitted a Project Plan (based on the Closure Plan) on May 31, 1990.

0.2 CLOSURE INVESTIGATION

The Closure investigation consisted of the following:

1. Sampling and analysis of soil samples from two on-site background locations. The background locations were defined as near-surface soils in areas where USDA had not applied or disposed of pesticides. It was not known whether or not the locations had received historical, legal application of pesticides prior to USDA's operation of the YARL facility.

2. Sampling and analysis of soil samples along the alignment of the former drainfield.

3. Sampling and analysis of soil samples adjacent to and beneath the septic tank excavation (confirmation sampling).

4. Sampling and analysis of soil samples from beneath the washdown pad excavation (confirmation sampling).

5. Developing risk assessment model to include exposure scenario, health-based

action levels and soil cleanup criteria. Determining applicability of ground water protection-based cleanup criteria.

0.3 POST-CLOSURE INVESTIGATION

The Post-Closure investigation included the following:

1. Installation of three new ground water monitoring wells, including one deep upper aquifer monitoring well and one year (5 rounds) of quarterly monitoring and monthly water level measurements of the seven on-site wells.

2. Review of previous reports and relevant available data concerning hydrogeology of the Yakima area, and assess uppermost aquifer at the YARL site, including aquifer parameters, ground water flow direction, hydraulic gradients, flow velocity and aquifer vulnerability.

3. Collection of representative soil samples for laboratory analysis to estimate the vertical permeability of the caliche and the aquifer materials.

0.4 CLOSURE AND POST-CLOSURE EVALUATION

Closure evaluation consisted of reviewing and validating soil quality data, applicable Washington State (MTCA, WAC 173-340) and EPA (40 CFR 265 Subpart G) regulations and establishment of final proposed soil action levels and preparation of the Closure Certification Report (submitted in November, 1991). The report concluded that the YARL site had been successfully closed and all structures containing pesticides above health-based cleanup criteria had been removed.

Post-Closure Evaluation consisted of reviewing and validating ground water monitoring data, applicable State (WAC 173-200; 173-340) and EPA 40 CFR 265 Subpart G regulations and a determination of site ground water quality. As this was clean closure, post-closure certification under 40 CFR 265.117 was not required. In actuality, the post-closure monitoring was performed after the initial phase of closure and during the final two phases of closure at YARL (after removal of the septic tank and washdown pad), and served to confirm that former pesticide disposal practices had not impacted ground water quality. The evaluation concluded that the ground water quality data were representative of the YARL site ground water conditions and that no further monitoring or sampling were required for assessment or detection monitoring purposes.

Our findings and conclusions to date support removal of the YARL facility from the National Priority List, pursuant to Section 300.425 (e) of the National Contingency Plan (NCP; 55 FR 8845, March 8, 1990). Removal from the list will generally follow a four step process:

1. EPA Regional Administrator approves Closure Report and certification.
2. EPA obtains State of Washington concurrence (from Dept of Ecology).
3. EPA publishes a notice of intent to delete YARL in the Federal Register, and a major newspaper in Yakima, and provides a public comment period.
4. EPA responds to comments received, and if YARL continues to warrant deletion, publishes a deletion notice in the Federal Register.

Until recently, some sites proposed for deletion had to undergo a "five year review", pursuant to Section 122(c) of CERCLA, to allow EPA time to ensure human health and environment are being protected. Most of these sites were Superfund sites where hazardous substances were allowed to remain, not sites such as YARL that underwent clean closure. EPA announced in December, 1991 that they will no longer require a five year review for all sites as a prerequisite for deletion from the NPL. However, certain sites will be monitored to ensure the effectiveness of the revised policy. Clearly, no further response action is necessary at YARL and it is eligible for deletion from the NPL based on the successful completion of the closure plan and required monitoring. It is difficult to estimate how long the process will take for deletion, as it will depend on the amount of time required for EPA to approve the closure report, time for EPA to receive concurrence from Ecology and time for public comment.

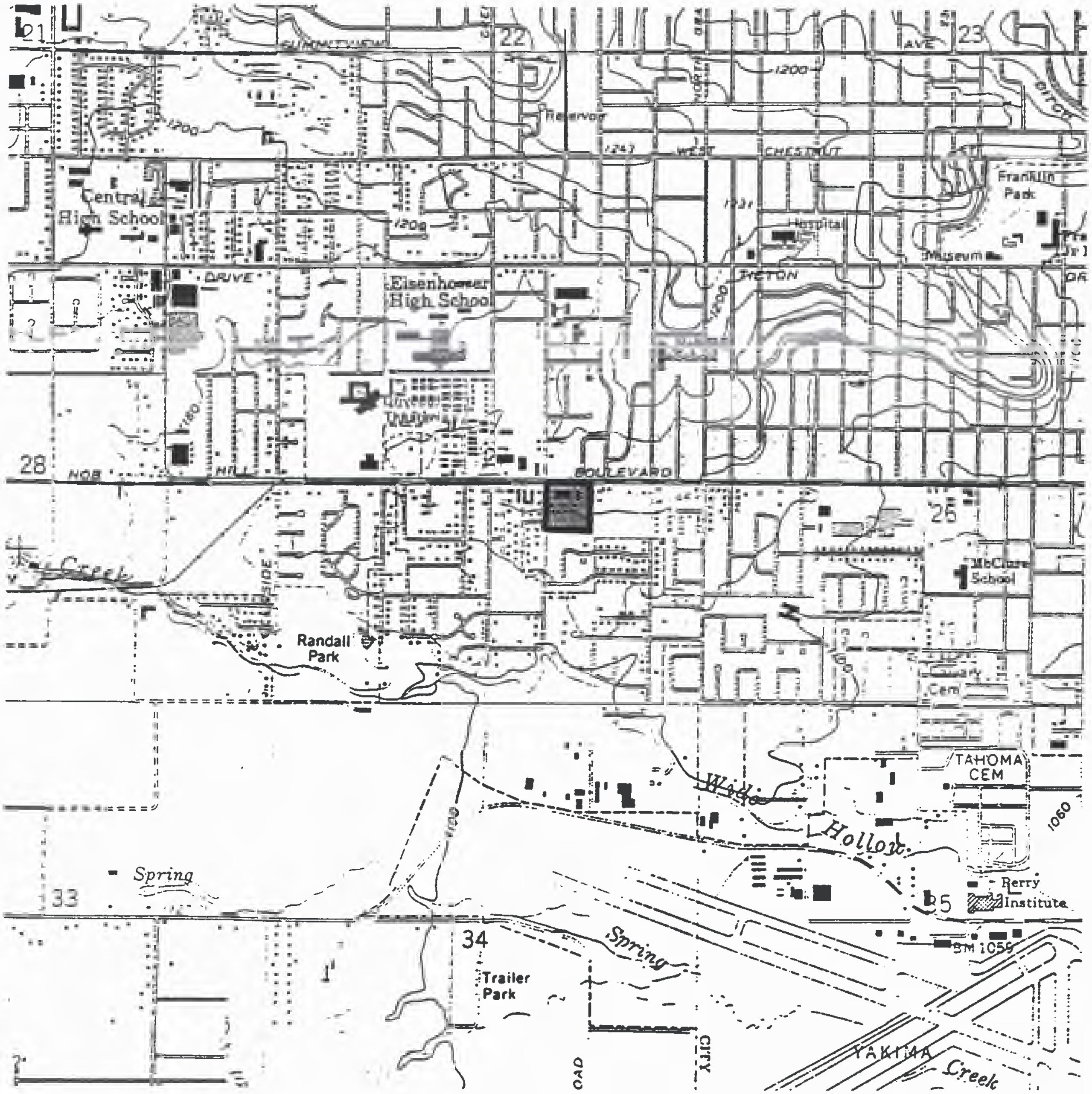
SECTION 1.0 INTRODUCTION

Yakima Agricultural Research Laboratory is located at 3706 West Nob Hill Boulevard in Yakima Washington (refer to Figure 1-1, Project Location Map). This report summarizes Hong West & Associates' effort over a period of 20 months at the YARL facility. Previously-submitted reports are listed below:

Critical Data Gap Analysis - April 23, 1990

Monitoring Well Report - August 29, 1990

First Post-Closure Monitoring Report - October 10, 1990



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SCALE IN FEET

Base Map: USGS Yakima West Quadrangle

HONG WEST & ASSOCIATES

YAKIMA AGRICULTURAL RESEARCH LABORATORY

PROJECT LOCATION MAP

PROJECT NO. 90042	FIGURE NO. 1-1

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Second Post-Closure Monitoring Report - January 23, 1991

Third Post-Closure Montoring Report - May 3, 1991

Fourth Post-Closure Monitoring Report - July 30, 1991

Fifth Post-Closure Monitoring Report - November 1, 1991

Raw Data (Submittal) - November 8, 1991

Closure Certification Report - November 19, 1991

Closure Certification (letter) - December 5, 1991

The purpose of this report is to provide sufficient project background information and hydrogeologic information so as to provide a framework for documenting all on-site and analytical activities during performance of the contract in a single report. For additional data or information, the reader is referred to the above-listed documents.

1.1 PROJECT UNDERSTANDING

USDA desires clean closure of the YARL facility to support delisting of the site from the CERCLA National Priorities List (NPL). Clean closure in compliance with RCRA 40 CFR 265 Subpart G was pursued instead of the CERCLA RI/FS and remedial process due to YARL's low hazard ranking and the technical feasibility of achieving source control at a site located in an arid region with little or no likelihood for ground water contamination.

1.2 PROJECT APPROACH

The approach selected for execution of clean closure was based on the approved RCRA closure plan of September, 1989. It consisted of waste disposal structure and limited soil removal and disposal and quarterly ground water monitoring as the basis for demonstrating compliance with 40 CFR 265.111 through 117.

1.3 PROJECT SCOPE AND AUTHORIZATION

Originally, the approved Project Plan (work plan) consisted of 18 tasks, as follows:

1. Critical Data Gap Analysis
2. Prepare Project Plan
3. Prepare Sampling and Analysis Plan
4. Aquifer Assessment
5. Prepare Safety Plan
6. Risk Assessment
7. Remove Septic Tank Contents
8. Remove Septic Tank
9. Assess Residual Contamination at Septic Tank
10. Remove Washdown Pad
11. Assess Residual Contamination at Washdown Pad
12. Drainfield Soil Sampling and Assessment
13. Monitoring Well Construction
14. Post-Closure Groundwater Monitoring
15. Site Restoration
16. Closure Certification
17. Report Preparation
18. Project Management

Task 19 was added to provide a scope of work for performing two limited soil overexcavations to remove soils with pesticide concentrations exceeding the proposed action levels. Authorization for the original scope of work was received in a signed contract on April 3, 1990.

1.4 PRE-CLOSURE DATA GAPS

The April 23, 1990 *Critical Data Gap Analysis* report described the following pre-closure data gaps:

1. Physical nature of septic tank contents
2. Analysis of shift in ground water flow direction
3. Background soil and water quality
4. Drainfield soil quality
5. Relationship of uppermost aquifer to deeper aquifer
6. Area well survey
7. Identification of unknown pesticides in tank

The YARL site investigation was successful in closing or rendering insignificant all the above data gaps. Refer to Sections 2.0 through 7.0 for specific reference to data gaps.

SECTION 2.0 PROJECT AREA PHYSIOGRAPHY AND GEOLOGY

The nature and distribution of geologic materials governs the behavior of ground water and subsurface migration of contaminants. The Yakima Basin is located between the Cascade Mountains on the west and the Columbia River on the east. The Wenatchee Mountains form the northern boundary and the Horse Heaven Hills form the southern boundary.

Basalt of the Columbia River Group covers 50,000 square miles in Idaho, Oregon and Washington, with depths in the Yakima Basin in excess of 5,000 feet (US Army Corps of Engineers). The younger flows are termed the Yakima Basalt Formation. Westward in the Basin, adjacent to the Cascade Mountains, these flows interfinger with the Ellensberg Formation, which consist of volcanic sediments, lacustrine deposits and alluvial sands and gravels.

The major geologic structures are young enough to have surface expression. Long, subparallel northwest to southeast ridges and valleys are part of a series of anticlinal ridges and synclinal troughs, produced by compressional forces related to the uplift of the Cascade Mountains. The troughs are partly filled with sediments, including the Ellensberg Formation and younger sand and gravel deposits. Wind-blown deposits, known as loess, together with volcanic ash are a locally important near-surface deposit.

The geology of the Yakima area consists of four major units, from top to bottom:

Aeolian (windblown) deposits: silt (loess); thickness 0 to 10 feet
Unconsolidated sands and gravels (such as Thorp gravel): thickness 0 to 30 feet
Ellensberg Formation, partially consolidated sand and gravel, thickness to 300 feet
Yakima Basalt, volcanic rock, thickness in excess of 1,000 feet.

Because the Yakima area has an arid climate (averaging about 7 inches of precipitation per year), well - developed secondary soil horizons characteristic of arid environments are important near-surface geologic features. The slow process of water percolating through the upper 10 feet of soils leaches and then precipitates soluble minerals, forming hard, pinkish brown soil layers known as caliche. Due to its physical properties, caliche is relatively impermeable and provides protection for deeper soil layers and ground water from surface contaminants.

The Yakima Basalt and Ellensberg Formation are host for regionally significant aquifers used for public water supply. Lower Ellensberg Formation and older deposits are folded in the region; the relatively youthful folds are reflected in modern day topography, as the axes of the the anticlines are closely associated with high basalt ridges, such as Manastash Ridge, while the axes of synclines are generally associated with valley bottoms.

SECTION 3.0 HYDROGEOLOGY

The HWA project team's characterization of the regional and site specific hydrogeology formed part of the basis for risk assessment at YARL.

3.1 REGIONAL HYDROGEOLOGY

The Yakima Basin includes more than 6000 square miles in south-central Washington. The Yakima Basin is the most extensively irrigated region in Washington, and has been the focus of numerous government-funded geologic and hydrologic studies (e.g. U.S. Army Corps of Engineers, 1978). Average annual irrigation diversions (surface/ground water) exceed 2.5 million acre/ft, on 532,000 acres. The Yakima Basin has been subdivided in the literature into several Basins and Subbasins. The YARL site area is located within the Upper Yakima Basin and Ahtanum-Moxee Subbasin (see Figure 2). Precipitation is asymmetric from west to east across the basin, averaging 7.8 inches/year in the YARL site area, with net infiltration approximately 4.5 inches/year.

This aquifer assessment is central to evaluating the closure and post-closure monitoring program at YARL, and for development of a risk model. An understanding of the ground water dynamics will provide the basis for establishing the relationship between septic contaminant disposal and potential effects on ground water quality. The hydrogeology of YARL cannot be fully understood unless it is placed within a regional context. Therefore, the YARL Aquifer Assessment includes assessment of regional ground water systems and site-specific ground water systems.

3.1.1 Basin Hydrostratigraphy

Three distinct ground water systems have been delineated in the Yakima Valley; an uppermost alluvial system, an intermediate sedimentary system and a lower basaltic system. The upper system is inferred to be unconfined and the lower systems are semi-confined to confined. Local variations may be superimposed on these generalized relationships. A fourth ground water system is inferred to occur below the basalt within crystalline basement rocks, but well data are sparse and the potential for beneficial use is questionable. As mentioned above, the lower part of the Ellensburg Formation and older geologic structures are folded and faulted in the Yakima Valley. Deposits proximal to the axes of major synclines generally contain ground water under artesian conditions. Flowing artesian wells are common throughout the Valley. Faults tend to form barriers to ground water flow. Because of the structural and geologic complexity of the region, the hydrogeology is highly variable, which is best evidenced by the wide range of well yields in the area, ranging from less than 5 gallons per minute to flowing artesian at 500 gallons per minute.

The upper alluvial aquifer in the vicinity of YARL consists of Recent (<10,000 yrs old) stream alluvium, Quaternary (0 - 1.6 million years) Eolian silts (loess) and fine sand (with local multiple caliche and tephra layers) and the Pliocene/Pleistocene (1.6 - 5.3 million years) Thorp Gravel, a coarse sand and gravel that is highly weathered and poorly indurated (units A, B and C on the accompanying cross section, Figure 3-1). The Thorp Gravel overlies the Tertiary age, 1 - 3 million years, Ellensburg Formation. The Thorp Gravel may or may not be present beneath YARL, and The Thorp and Ellensburg units are lithologically similar. The partially or poorly indurated gravels beneath YARL are for the purposes of this study interpreted to be Thorp Gravel. The semi-consolidated to consolidated sediments and volcanic flows of the Ellensburg interfinger with the uppermost flows of the Yakima Basalt (part of the Columbia River Basalt Group). Characteristics of each ground water system are summarized on the accompanying cross section (Figure 3-1).

3.1.2 Basin Ground Water Extraction

Ground water exploitation in the Yakima Basin is widespread, and all three of the principal aquifer systems are utilized. 13.9% of ground water withdrawals are for municipal supplies; 72.8% of withdrawals are for irrigation purposes and 13.7% of withdrawals are for residential use. Most of the residential wells are completed within the uppermost aquifer, although this practice has been discouraged in recent years due to the environmental vulnerabliity of this aquifer and widespread occurrence of reliable ground water within the Ellensburg Formation.

Ground water development has historically been unplanned and unmanaged in the Yakima area. The City of Yakima currently receives its water supply from the Naches River (via treatment plant), but has previously used supply wells completed in the basalt aquifer. The City also plans to develop a supply well in the Ellensburg Formation. A private water purveyor, Nob Hill Water District, maintains 5 deep basalt wells, 3 of which are currently active which serve approximately 6,000 customers in the Yakima Valley. Well yields are generally highest in the basalt aquifer and lowest in the upper alluvial aquifer, although there are exceptions. Well construction methods play an important role in determining yield potential. The most common method, open-ended casing, generally produces wells with low efficiency, due to the limited hydraulic connection with the aquifer materials. Wells with perforated casing or screens that are properly developed have higher yields. For example, the average open-ended casing well placed in the upper alluvial aquifer yields 50 gallons per minute. The Town of Kittitas maintains a gravel-developed wellfield in the alluvial aquifer that produces over 500 gallons per minute. In summary, well construction methods play an equally important role as the physical properties of the aquifer materials in determing well yields in the Yakima Basin.

3.1.3 Basin Recharge/Discharge

Within the Yakima Basin, regional, intermediate and local ground water recharge/discharge relationships have been described in the literature. Regional flow systems generally have recharge/discharge areas along the margins of the Columbia Plateau physiographic province. Intermediate flow systems are areas of exchange between shallow and deep flow systems and the surface and local flow systems are generally correlative with topographic highs and lows and surface drainage basins. Intermediate flow systems are recharged indepedently of local systems and flow may be tranverse to local or regional flow systems. Also, the recharge/discharge areas do not always necessarily occupy highest or lowest elevations within the intermediate systems.

The sedimentary and basalt aquifers contain intermediate to regional flow systems, while the uppermost sedimentary aquifer contains local and intermediate flow systems. Intermediate flow systems and inter-aquifer exchange are difficult to assess without detailed well information.

Natural recharge occurs regionally in three ways: from direct precipitation and infiltration, through infiltration losses from surface waters and from inter-aquifer exchange. Surface waters flow from the Cascade Mountains to the west and are bedded in older alluvial deposits and basaltic bedrock. The Columbia, Yakima and other rivers within the basin discharge to ground water and receive flow from ground water along their courses. Precipitation infiltration recharge occurs primarily during the winter months. Artificial recharge occurs locally via septic system drainfields, stormwater runoff seepage and primarily during the summer months, from irrigation. Irrigation in the Yakima Basin on a regional scale is the most significant recharge mechanism. Recharge mechanisms are summarized below:

Mechanisms	Recharge (Acre-ft/yr)
Precipitation	98,000
Stream Loss	301,000
Artificial (irrigation, etc)	556,000

NET RECHARGE: 955,000 acre-ft/yr = 3×10^{11} gal/yr

3.1.4 Potential for Contamination

The uppermost aquifer in the Yakima Valley is susceptible to pollution due to its proximity to the surface and to its hydraulic connection with the Yakima River and other surface waters. In general, the alluvial deposits have high infiltration rates, and therefore the potential for pesticide and fertilizer compounds to enter the upper aquifer is high. Where they are well developed and greater than a few inches thick, caliche soil horizons provide a measure of protection to shallow ground water systems.

The deeper sedimentary and basalt aquifers are not likely to be polluted by agricultural chemicals because their recharge areas are generally removed from surface contaminant sources and because the "residence time" of ground water is such that natural attenuation and dispersion would tend to eliminate contaminants.

3.2 YARL AQUIFER ASSESSMENT/CONCEPTUAL GROUND WATER MODEL

Refer to Figure 3-1 for a generalized north to south hydrostratigraphic section of the YARL area, based on interpretation of Ecology well logs. The upper aquifer at YARL is contained within a stratified alluvial sequence consisting of silt, sand and gravel. Examination of boring logs indicates that the upper 100 feet of the alluvium fines upward, possibly grading into eolian silt (loess). The permeability of the vadose zone soils is expected to be lower than the permeability of soils below the water table, based on well log information. In particular, a well-developed caliche horizon (typical of arid climate soil development) at 8 to 10 feet below ground surface is a significant low permeability layer with the ability to impede contaminant transport. There may be other caliche and tephra layers at depth.

3.2.1 Estimates of Aquifer Parameters

As indicated in Figure 3-1, our conceptual ground water model includes three aquifer types.

LOCAL SYSTEM - Upper Aquifer

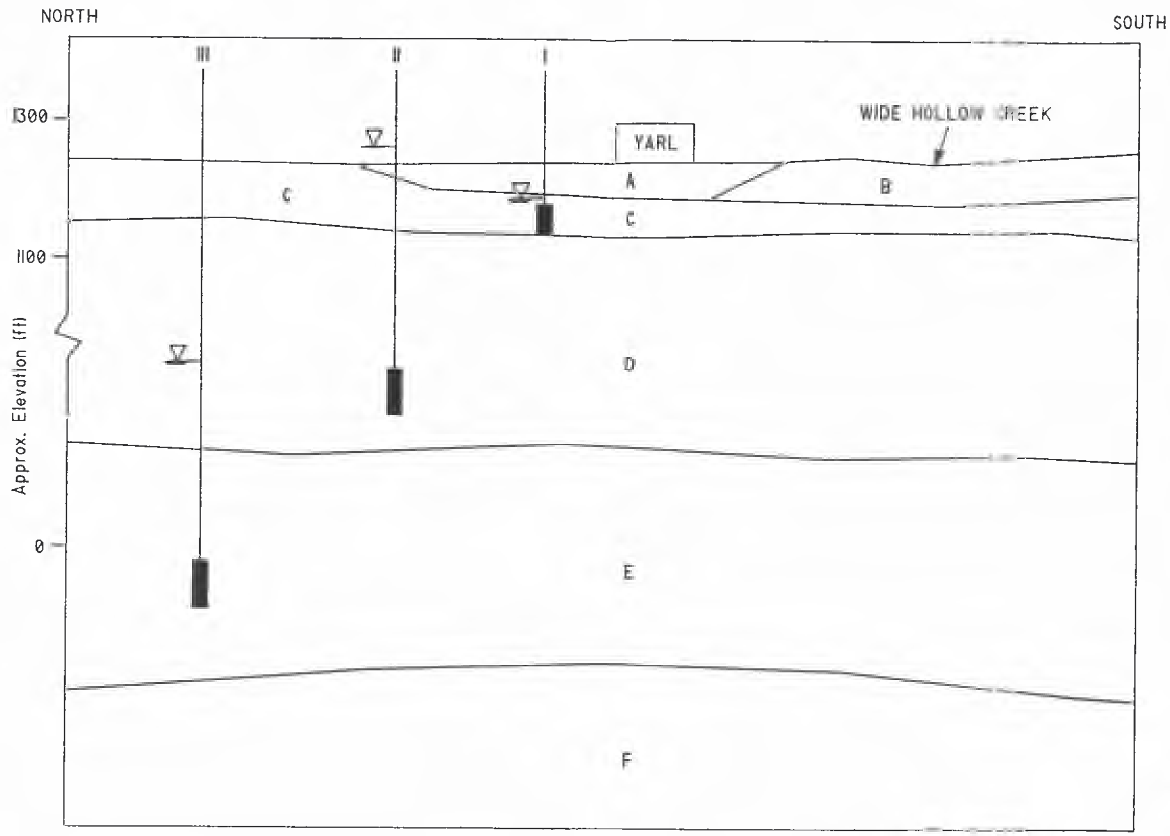
Vadose zone permeability -soils are generally classified as silt and silty sand (ML or SM) and would have expected vertical permeabilities on the order of 10^{-4} to 10^{-5} cm/sec. Individual caliche horizons may have lower vertical permeabilities.

AQUIFER TYPES

I = ALLUVIAL AQUIFER
- 0 TO 60' THICK
- UNCONFINED
- YIELDS TO 50 GPM
- DOMESTIC USE
- LOCAL GROUND WATER SYSTEM

II = SEDIMENTARY AQUIFER
- > 80' THICK (UP TO 1000')
- SEMI-CONFINED
- YIELDS TO 700 GPM
- INDUSTRIAL/IRRIGATION AND MUNICIPAL USE
- INTERMEDIATE GROUND WATER SYSTEM

III = BASALT AQUIFER
- > 1000' THICK
- CONFINED/SEMI-CONFINED
- YIELDS TO 1500 GPM
- MUNICIPAL USE
- REGIONAL GROUND WATER SYSTEM



LEGEND

THICKNESS AT YARL	MAPPED UNIT	
15'	A	LOESS
0-5'	B	ALLUVIUM
30-40'	C	GRAVEL (THORP FORMATION)
>85'	D	CEMENTED GRAVEL (ELLENSBURG FORMATION)
NO DATA	E	BASALT (YAKIMA BASALT)
NO DATA	F	CRYSTALLINE BASEMENT

I — AQUIFER TYPE/PIEZOMETER AND RELATIVE POTENTIOMETRIC SURFACE OF CORRESPONDING AQUIFER/GROUND WATER SYSTEM.

DRAWING NOT TO SCALE

HONG WEST & ASSOCIATES

YAKIMA AGRICULTURAL RESEARCH LABORATORY

GENERALIZED HYDROSTRATIGRAPHIC SECTION

PROJECT NO. 90042 FIGURE NO. 3-1

Aquifer permeability - previous studies (Biospherics, 1988) on-site at YARL included slug tests using Horslev (1951) methodology. Calculated K values were on the order of 10^{-3} cm/sec. Estimated K values (after Powers, 1981) of aquifer samples obtained during this investigation based on grain size distribution indicate a possible range of aquifer permeability on the order of 10^{-2} to 10^{-3} cm/sec.

Groundwater flow rate - based on measured water levels, the hydraulic gradient is approximately .008 ft/ft, which would yield flow velocities on the order of .3 to .5 ft/day beneath the YARL site, using Darcy's Law $v = Ki/n$, n being an assumed porosity of 20%.

Water level fluctuations - Analysis of ground water monitoring data taken from 3/88 to 3/90 indicates a seasonal fluctuation of approximately 1.70' in water levels at the YARL site. Based on extrapolation of monitoring data, seasonal high water tables occur in September or October, corresponding to a response to peak irrigation season. Seasonal low water tables occur in March, corresponding to the period just prior to the new irrigation season.

Ground Water Flow Direction - Analysis of ground water monitoring data indicates that ground water flows beneath the YARL site in a general south-southeasterly direction. We could find no clear explanation for a previously inferred shift in flow directions (from easterly to southerly). Most of the water table contour maps generated from the monthly water level monitoring indicated a southeasterly flow direction.

Surface water relationship - The YARL site is located within the Wide Hollow Creek drainage. Wide Hollow Creek drains 64.8 square miles and empties into the Yakima River near Union Gap. The creek accepts irrigation return flows, urban and agricultural runoff, ground water discharge, and discharge from the Union Gap Sewage Treatment Plant (downstream from YARL). The creek is classified as Class A water and is used to supply a nearby fish hatchery.

Hydraulic connection to deeper aquifers - Based on the monthly water level readings from deep and shallow aquifer wells at YARL, an upward gradient exists during all seasons beneath the site in the uppermost unconfined aquifer. Insufficient site specific data exist to quantify the degree of hydraulic connection; this cannot be done without placing piezometers in deeper aquifers. However, based on the available regional data and the known upward vertical gradient at YARL, the degree of hydraulic connection is probably minimal.

INTERMEDIATE/REGIONAL SYSTEMS - Sedimentary and Basalt Aquifers

As mentioned above, very little information exists concerning the presence, depth to and hydraulic characteristics of the deeper aquifers at YARL. The uppermost aquifer may be contained within the upper alluvium or the Ellensburg Formation. It is possible that the alluvial deposits at YARL are hydraulically connected to the sediments of the Ellensburg Formation. The sedimentary aquifer (Ellensburg Formation) may be present at approximately 60 feet. The identifying criteria for Ellensburg Formation versus Thorp Gravel or other alluvium is degree of induration. Boring logs for the YARL site monitoring wells indicate that cemented gravels were encountered at approximately 65 feet. The basalt aquifer is assumed to be present at depths exceeding 500 feet. Hydraulic separation between the Ellensburg Formation aquifer units and the deeper Yakima Basalt units may be silty, cemented sandy gravels of the lower Ellensburg, or massive, relatively unfractured basalt units near the top of the Yakima Basalt.

3.2.2 Area Well Inventory

As of late 1990, there were approximately 70 wells located within a one mile radius of the YARL site, refer to Figure 3-2 Well Inventory Map. The types of wells, depths and characterisitics are summarized below:

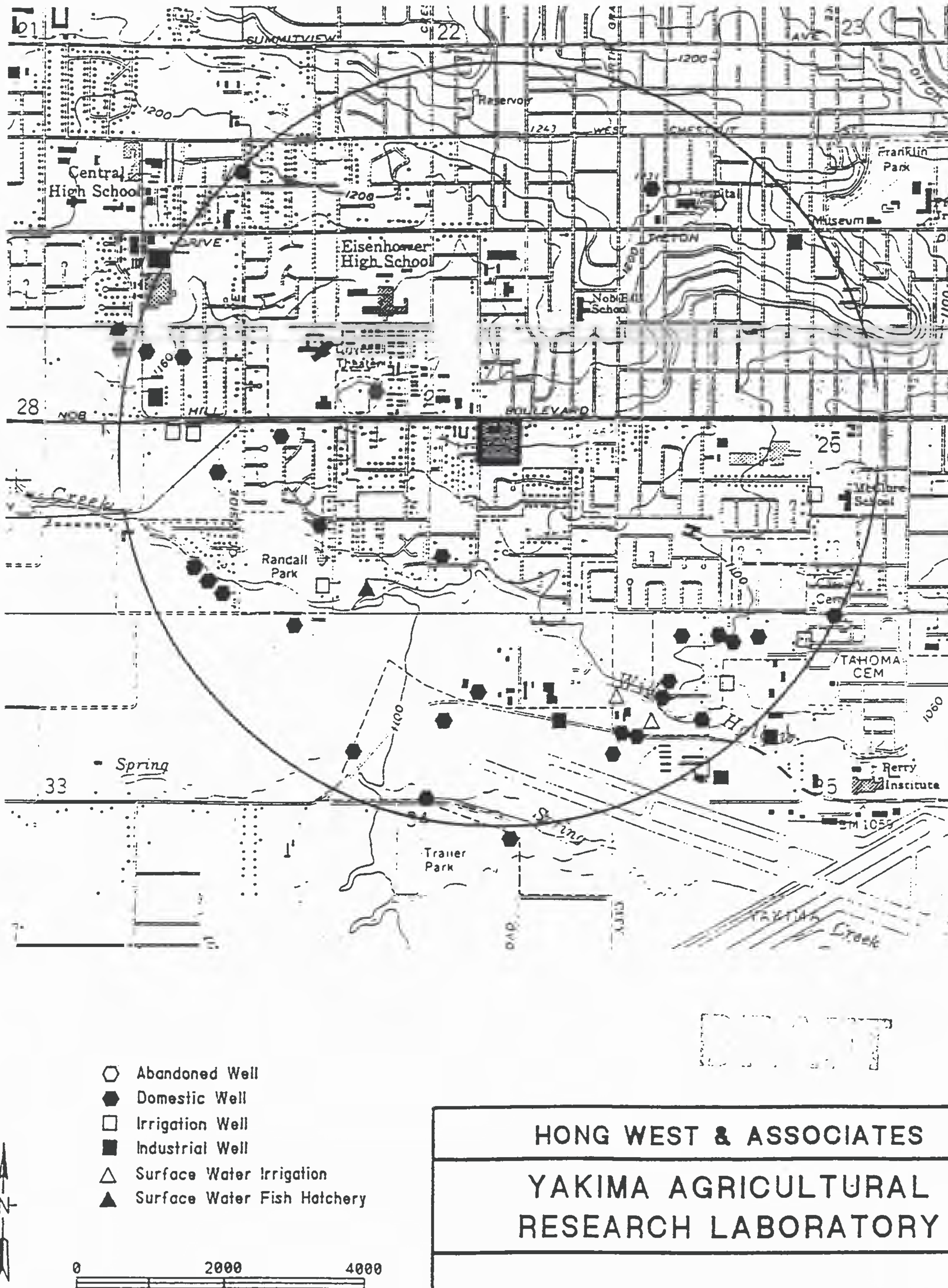
1. 60% are shallow, domestic supply wells that yield 5-50 GPM and are drilled in the upper 40 feet of the upper aquifer. Most of these wells are open-ended casings.

2. Another 20% are domestic wells drilled in a more highly transmissive (30-50 GPM) portion of the upper aquifer (or possibly the upper portion of the Ellensburg Formation), 60-120 feet below ground surface.

3. 10% of the wells are wells used for irrigation purposes, drilled from approximately 260-400 feet and yield up to 100 GPM.

4. The remainder of the wells are industrial supply wells, placed at varying depths in the alluvial sequence.

It is reasonable to assume that there are older, possibly abandoned or unrecorded irrigation and private supply wells scattered throughout the general area.



Well Inventory Data as of October, 1990
Base Map: USGS Yakima West Quadrangle

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YAKIMA AGRICULTURAL RESEARCH LABORATORY

AREA WELL INVENTORY MAP

PROJECT NO. 90042	FIGURE NO. 3-2

As mentioned previously, the most common well construction method is open-ended casing. Perforated wells are rare. Increasing well yields with depth may be attributable to increased transmissivity and hydraulic head within discrete zones in the sedimentary aquifer, and possibly related to partial penetration effects. Confined and semi-confined conditions are likely within the sedimentary aquifer system, on a local scale, with confining pressure generally greatest along the axes of major synclinal folds.

Of the above 70 wells, 10% are assumed to be abandoned, based on interviews with Nob Hill Water District personnel who indicated that several new customers in the vicinity abandoned shallow domestic wells and tied into the community water system.

One major water supply well (Nob Hill Water District, a private water purveyor) is located approximately 1.2 miles WNW of the YARL site. This well is within the lower Basalt/Bedrock Aquifer and yields up to 1600 GPM, and is over 1500 feet deep.

3.2.3 Ground Water Extraction Influences

Well withdrawals for the uppermost aquifer are estimated, using the following averages:

private domestic well: 50 wells @ 1500 gpd = 75000 gal

Aquifer storage in 1 mile radius: (assume saturated thickness 25'and bulk porosity at 20%):

= 300,480,000 gallons or 92.2 Acre/ft

75,000 gpd withdrawal = .025% aquifer storage

In summary, although the uppermost aquifer has significant beneficial use in the YARL area, ground water withdrawal volumes are relatively small compared to total aquifer storage. In addition, the majority of the shallow wells pump intermittently and at low rates and are expected to have small radii of influence; therefore, it can be inferred that there are no ground water withdrawals that could potentially affect ground water flow in the vicinity of the YARL site, for any appreciable length of time or appreciable distance.

3.2.4 Potential Contamination Receptors

The nearest down-gradient water supply well is approximately 1800 feet southwest (off-gradient) of the YARL site boundary. Assuming the detection monitoring system revealed significant contamination at the Point of Compliance, and the estimated flow rate of .5

ft/day, it would take nearly 10 years for contaminants to reach the nearest well. Allowing for expected adsorption and dispersion, the threat to sensitive receptors appears to be negligible. Two years of monitoring data have not detected highly soluble and mobile contaminants in concentrations that would pose a significant threat to down-gradient receptors.

4.0 FIELD INVESTIGATIONS

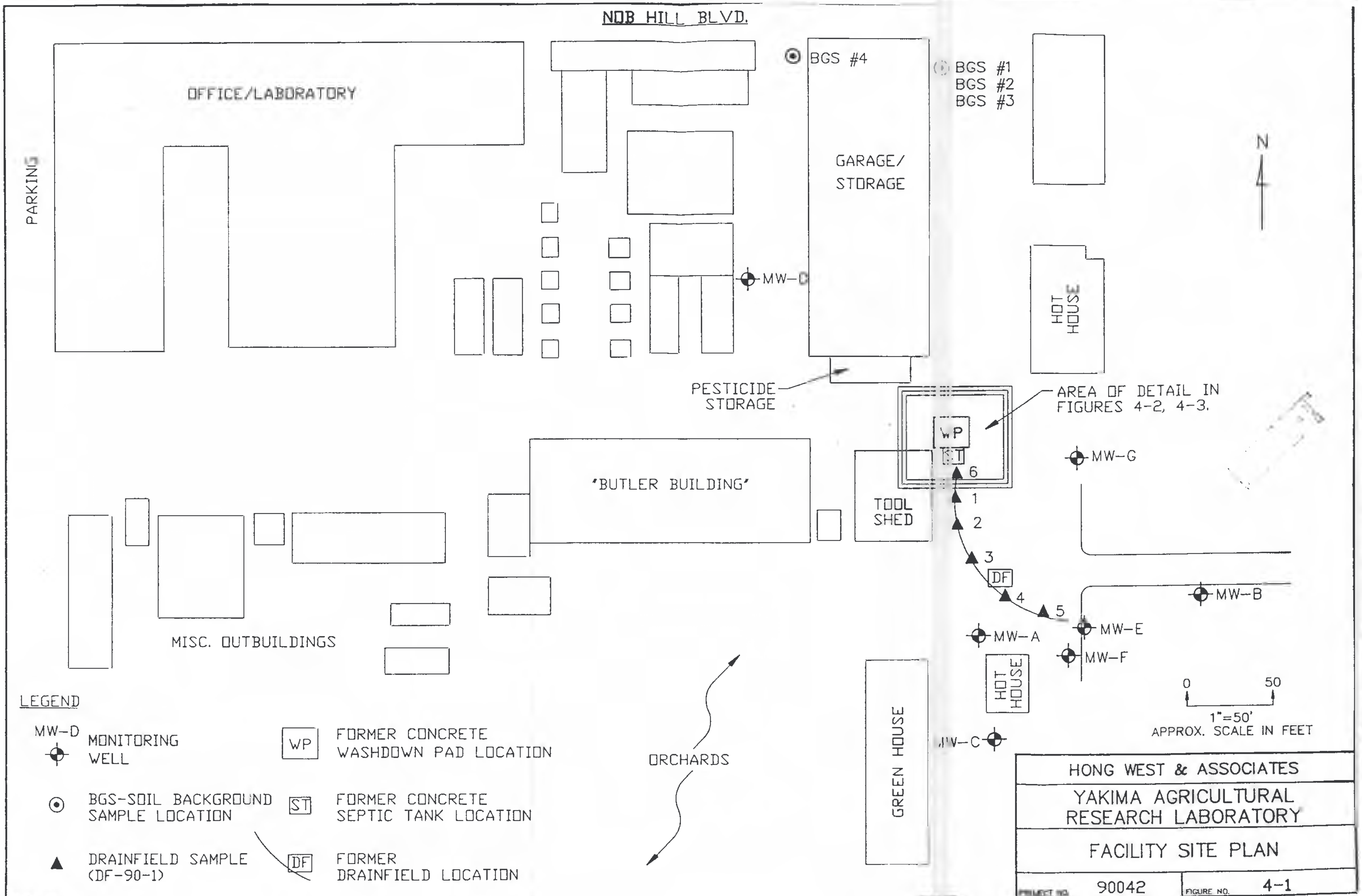
The history of field investigations includes the initial site inspection by EPA in 1982, Department of Ecology sampling in 1983, a preliminary study by Biospherics, Inc. in 1988 and the present study. Field investigations by HWA were carried out to support the closure and post-closure assessment montitoring effort. Refer to Figure 4-1 for the Facility Site Plan.

4.1 CHRONOLOGY OF PREVOUS STUDIES AND INVESTIGATIONS

EPA/Ecology & Environment, 1982 - The United States Environmental Protection Agency sent a Field Investigation Team (FIT) to YARL in 1982 to conduct preliminary investigations of the septic tank and drainfield area. Field work was limited to shallow soil sampling and one attempt to drill to ground water with an auger rig - which met refusal at about 21 feet below ground surface. This study concluded that near-surface soils at YARL were contaminated with pesticides as a result of the discharges from the septic system, and that the likelihood for ground water contamination was high. Ecology & Environment also performed the hazard ranking calculation of 29.33. This score used an incorrectly assumed ground water depth of less than 20 feet (actual average depth is 35 feet). Based on the results of this investigation and hazard ranking, EPA placed YARL on the National Priority List (NPL) pursuant to CERCLA.

Washington Department of Ecology, 1983 - WDOE conducted additional sampling of the septic tank contents and the drainfield area on two occassions in March, 1983. The first set of samples were mostly negative with the exception of trace concentrations of lindane and DDT. The second sampling event (from similar locations) detected a large number of pesticides in soil. An initial closure plan was approved in May, 1987 by Ecology, following submissions by USDA in 1985 and March, 1987. Later U.S. EPA determined that the Ecology-approved closure plan did not meet 40 CFR 265 Subpart G requirements, and that a revised closure plan be submitted, following completion of additional testing and monitoring. USDA then hired Biospherics, Inc. to conduct the additional investigations in support of the RCRA closure plan.

Biospherics, 1988 - This project included removing the drainfield, sampling soils within the


NOB HILL BLVD.
OFFICE/LABORATORY
PARKING
BGS #4
BGS #1
BGS #2
BGS #3
GARAGE/ STORAGE
N
MW-D
HOT HOUSE
PESTICIDE STORAGE
AREA OF DETAIL IN FIGURES 4-2, 4-3.
WP
ST
6
1
2
3
DF
4
5
MW-G
'BUTLER BUILDING'
TOOL SHED
MW-B
MW-E
MW-A
MW-F
HOT HOUSE
MISC. OUTBUILDINGS
0
50
1"=50'
APPROX. SCALE IN FEET
GREEN HOUSE
MW-C
ORCHARDS
LEGEND
MW-D
MONITORING WELL
BGS-SOIL BACKGROUND SAMPLE LOCATION
DRAINFIELD SAMPLE (DF-90-1)
WP
FORMER CONCRETE WASHDOWN PAD LOCATION
ST
FORMER CONCRETE SEPTIC TANK LOCATION
DF
FORMER DRAINFIELD LOCATION
HONG WEST & ASSOCIATES
YAKIMA AGRICULTURAL RESEARCH LABORATORY
FACILITY SITE PLAN
PROJECT NO.
90042
FIGURE NO.
4-1

drainfield excavation, sampling of soils outside the septic tank/drainfield area, installation of 4 ground water monitoring wells, in-situ hydraulic aquifer testing (slug tests) and quarterly ground water monitoring and sampling. Sampling was conducted for a lengthy list of primary and indicator parameters developed to determine ground water quality and monitor for the presence of compounds believed to have been discharged through the septic tank/drainfield system.

The study confirmed soil contamination was likely in the drainfield and septic tank areas, but concluded that the likelihood for ground water contamination or off-site transport of contaminants was "vanishingly low" and recommended clean closure under RCRA.

4.2 CLOSURE INVESTIGATION - SOIL SAMPLING

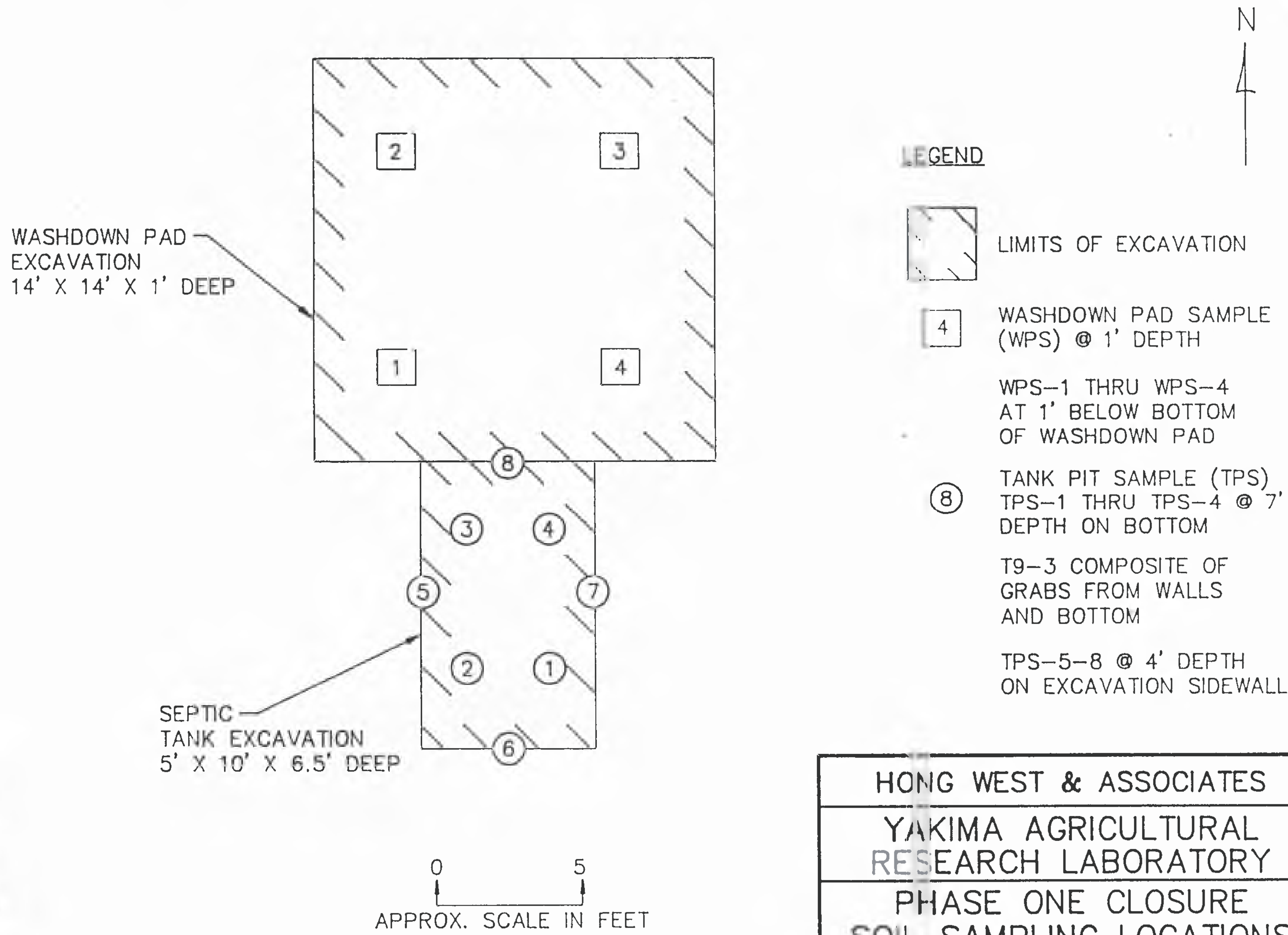
4.2.1 Phase One

Confirmation sampling of in situ soils remaining below the excavations was performed in order to assess/demonstrate removal of hazardous waste residues as per 40 CFR 265 Subpart G. During the afternoon of June 11th, 1990, the HWA team completed a soil sampling program within the tank excavation.The completed tank excavation was approximately 5 feet in width, 10 feet in length and 5.5 feet deep. Wooden planks were laid across the top of the hole to accommodate the sampling crew. The crew consisted of one HWA representative and one from Chemsafe.

The samples were taken in order from 1 to 8 as shown in Figure 4-2, Phase One Soil Sampling Locations. As indicated on the map, samples 1 through 4 were taken from the bottom of the pit and 5 through 8 from the pit walls (Refer to Plate 5 for photo). In addition, a composite soil sample (T9-3) was prepared which included soil from the pit bottom and walls, for subsequent EPA method 8140 analysis). All of the samples were taken with stainless steel augers or scoops. The sampling equipment was washed and rinsed prior to re-use. Samples of the wash and rinse water were also taken for laboratory analysis. The sampling was undertaken at personal safety level D.

Four soil samples were taken during the afternoon of June 11th, 1990 (one in each quadrant) within the area previously overlain by the concrete washdown pad. The samples were taken with a stainless steel sampler which was washed and rinsed after each sample. Refer to Figure 4-2 for sampling locations.

Soil sampling within the drainfield was conducted on June 18th and 19th, 1990, with a B-80 hollow stem auger drill rig provided by Ponderosa Drilling Co. The first set of soil samples was obtained on June 18th, 1990. The former drainfield was located by Denise



HONG WEST & ASSOCIATES

YAKIMA AGRICULTURAL RESEARCH LABORATORY

PHASE ONE CLOSURE SOIL SAMPLING LOCATIONS

PROJECT NO. 90042 FIGURE NO. 4-2

90042-A-002.2

MIlls, of Sweet-Edwards/Emcon, who was on-site supervisor during the removal of the drainfield in 1988. All samples were taken utilizing stainless steel split spoon samplers (Refer to Plate 7 for photo). At each location soil was sampled at the level immediately above where caliche was encountered. The caliche level was identified initially by a marked increase in soil density (SPT blow count increase) and later confirmed visually. Prior to sampling, all the augers and samplers were steam cleaned. A clean set of augers was used at each sample location. The soil samples were removed from the split spoon and sealed within sample jars. The sample jars were kept on ice in a plastic cooler during the sampling process. The split spoons were washed and rinsed prior to re-use.

A total of 7 soil samples were taken. The sample locations are marked on Figure 4-1. Sample number DF-7 was a duplicate of sample DF-4. Additionally, two rinsate water samples were obtained after the sampling was completed. All samples were transmitted to the Biospherics lab at the end of the day via FEDEX.

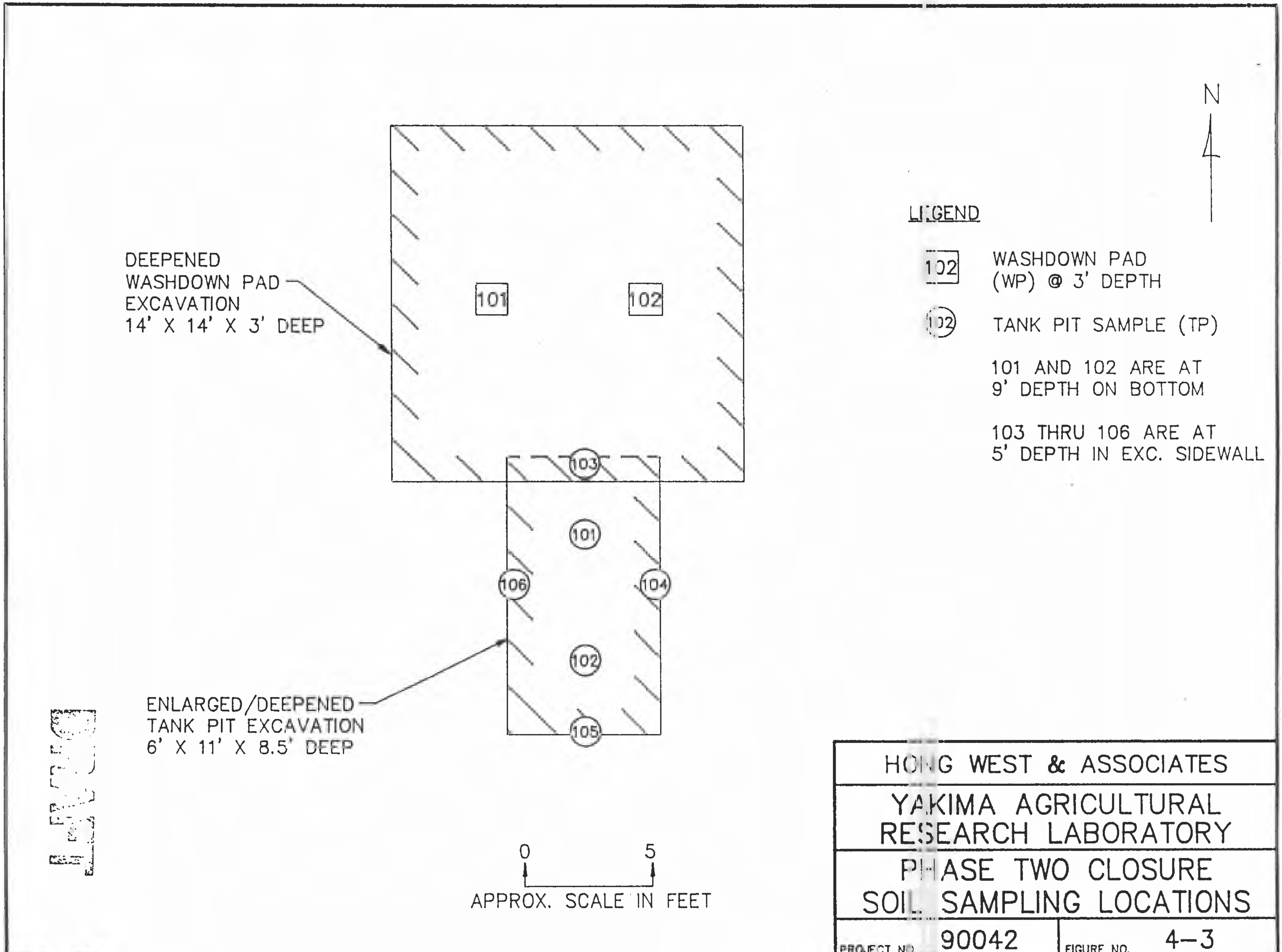
4.2.2 Phase Two

Soil sampling and analysis in the former drainfield (removed prior to HWA's contract) revealed pesticide concentrations below action levels, and at levels similar to those detected during the Biospherics (1988) study. Based on this assessment, no further action was taken in the drainfield area. Action levels for soils beneath the former septic tank and washdown pad were exceeded for disulfoton, DDT and dieldrin. Accordingly, the clean closure effort was modified to include limited overexcavation of soils immediately adjacent to and below the former tank and pad. Phase Two Partial Closure consisted of overexcavation of soils and confirmation sampling, and was completed between October, 1990 and January, 1991.

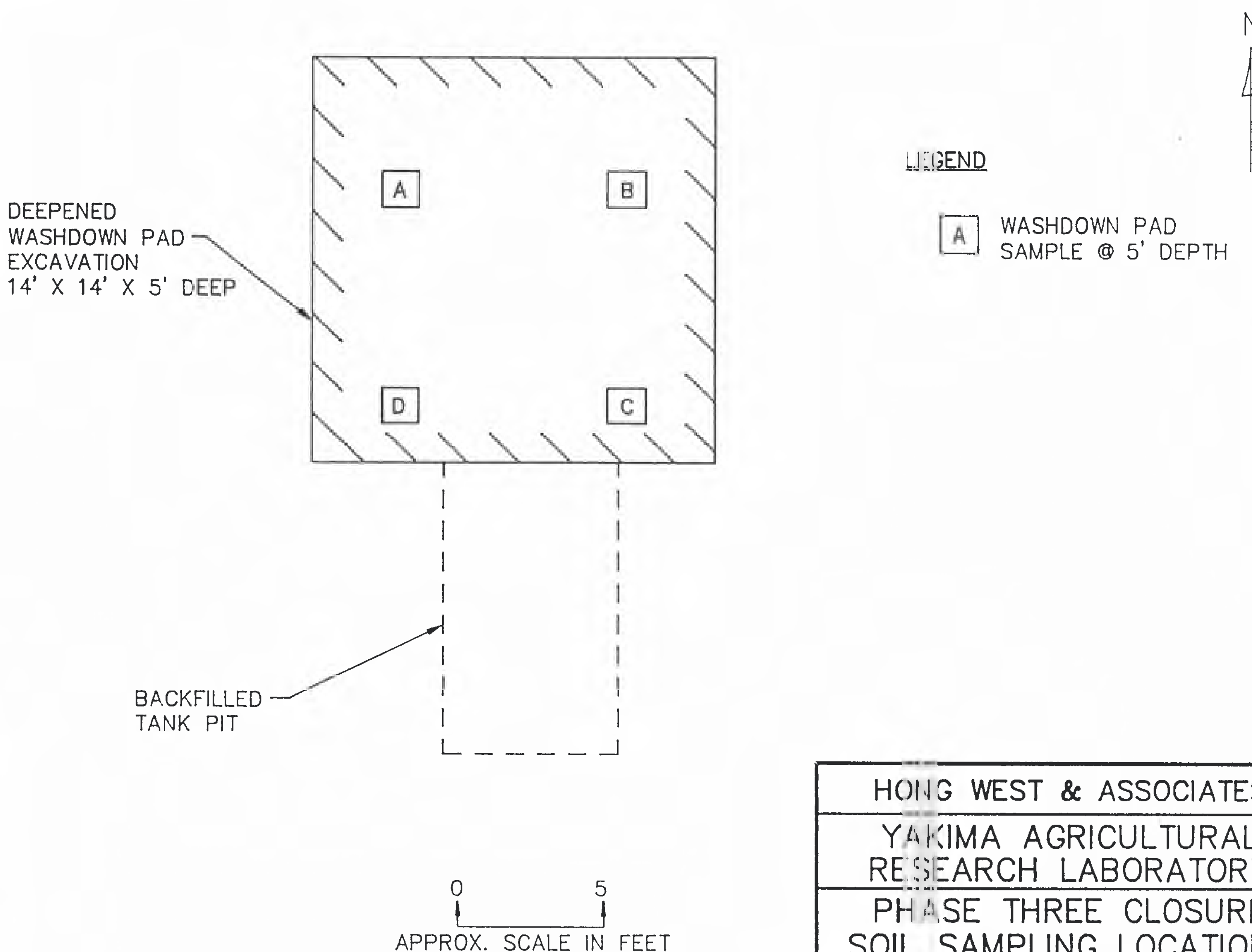
A sequential program of soil excavation and stockpiling was followed, as described in the modified Task 19 scope of work. Based on the results of the previous sampling, the original 5 cubic yard stockpile and the first one foot lifts from each excavation were determined to be contaminated and required off-site disposal. Six samples were obtained from the enlarged tank pit excavation, four from the sides and two from the tank bottom. Refer to Figure 4-3. Two samples were obtained from the deepened washdown pad excavation, one from the center of the western half, one from the center from the eastern half. Refer to Figure 4-3.

4.2.3 Phase Three

Phase Three Final Closure consisted of a second overexcavation of the washdown pad area, confirmation sampling/evaluation and final disposal of all previously stockpiled soil and contaminated materials. This portion of closure was completed between June, 1991 and October, 1991. Excavation of soils was immediatedly followed by collection of four


N
LEGEND
102 WASHDOWN PAD (WP) @ 3' DEPTH
102 TANK PIT SAMPLE (TP)
101 AND 102 ARE AT 9' DEPTH ON BOTTOM
103 THRU 106 ARE AT 5' DEPTH IN EXC. SIDEWALL
DEEPENED WASHDOWN PAD EXCAVATION 14' X 14' X 3' DEEP
101
102
103
101
106
104
102
105
ENLARGED/DEEPENED TANK PIT EXCAVATION 6' X 11' X 8.5' DEEP
0
5
APPROX. SCALE IN FEET
HONG WEST & ASSOCIATES
YAKIMA AGRICULTURAL RESEARCH LABORATORY
PHASE TWO CLOSURE SOIL SAMPLING LOCATIONS
PROJECT NO. 90042
FIGURE NO. 4-3

90042-A-003.2



HONG WEST & ASSOCIATES

YAKIMA AGRICULTURAL RESEARCH LABORATORY

PHASE THREE CLOSURE SOIL SAMPLING LOCATIONS

PROJECT NO. 90042 FIGURE NO. 4-4

90042-A-004.2

confirmation samples from approximately 0.5 feet below the excavation bottom. The identical sampling procedures and equipment were used during the second overexcavation as were used during the previous sampling events; refer to Figure 5 for sample locations.
4-4

Indicator compounds (dieldrin and DDTr) were chosen prior to the second overexcavation; hence, only pesticide-specific sampling was performed. DDTr levels were all less than 10 ppb (2 orders of magnitude below action level). Dieldrin was non-detected in 3 of 4 samples. The detection (sample D) was 42 ppb. Low concentrations of endosulfan and endosulfan sulfate were also detected.

TABLE 4-1

SOIL ANALYTICAL METHODS

PARAMETER	METHOD	NO. OF ANALYTES	TOTAL NO. OF ANALYSES *
Cyanide	9010	1	31
TCL Metals	EPA 6010, 7470	24	31
Volatile Organics	EPA Method 8240	34	31
Semi-volatile Organics	EPA Method 8270	68	31
Organochlorine Pesticides/PCBs	EPA Method 8080	26	35
Organophosphorus Pesticides	EPA Method 8140	11	31

Notes: * Increased number of analyses for 8080 due to scoping of analysis for Phase Three final closure confirmation sampling.

4.3 POST-CLOSURE INVESTIGATION - MONITORING WELL CONSTRUCTION/SAMPLING

Three monitoring wells were constructed on site between June 18th and August 6th, 1990. All drilling, well construction and development was supervised and inspected by Hong West and Associates' geologists. The soil boring logs were prepared on site by the geologist during well drilling and construction, and modified accordingly after reviewing samples in the laboratory/office. Refer to the Monitoring Well Report, dated August 29, 1990 for lithologic and well construction details. The three wells completed are labeled

MW-E, MW-F and MW-G. The location of each well is marked on Figure 4-1. Well logs appear in the Appendix.

All monitoring wells were constructed using threaded 2-inch PVC pipe as a riser and either a 2.5 foot or 10 foot section of slotted PVC tubing with 0.020-inch slot widths as a screen. A filter pack of Colorado 10/20 silica sand was placed around each screen and bentonite chips and bentonite grout were used to seal and backfill the hole. As the pipe and backfill were placed, the 6-inch diameter casing was withdrawn from the hole. An eight inch diameter security casing with a locking lid was installed at the surface and embedded in concrete. The well casing was protected from harm by embedding three 4-inch diameter steel pipes in a triangular array about the casing in concrete. The monitoring wells were developed using a single pipe airlift technique. Compressed air, filtered for both liquid and particulate matter, was conducted to the screened zone through a 1-inch diameter PVC pipe. The pipe was systematically raised and lowered over the screen during development. Samples of the water lifted during development were tested at regular intervals for pH and conductivity. Development was continued until pH, temperature and conductivity stabilized.

Dedicated pumps were installed in each of the newly completed wells. The *Well Wizard* model # T-1200 pumps were installed in accordance with the manufacturers specifications. Wellhead elevations (ground and top of casings) were surveyed by Gray Surveying, Inc. of Yakima Washington to USGS datum. Table 4-2 summarizes the final monitoring well information at YARL.

TABLE 4-2
Yakima Agricultural Research Laboratory
Monitoring Well Data Summary

Well No.	Ground Surface Elevation Feet	Top of Casing Elevation Feet	Drill Depth Feet	Screen Depth Feet B.G.S.	Screen Elevation Feet
MW-A	1138.22	1141.54	46	32-42	1109.54-1099.54
MW-B	1139.41	1141.94	50	37-47	1104.94-1094.94
MW-C	1137.68	1140.98	50	32-42	1108.98-1098.98
MW-D	1141.00	1141.00	90	36-46	1105.00-1095.00

MW-E	1138.54	1141.03	124	120.5-123	1120.53-1018.03
MW-F	1138.38	1141.28	55	35-45	1106.28-1096.28
MW-G	1139.87	1142.43	52	37-47	1105.43-1095.43

4.4 CLOSURE/POST-CLOSURE SUMMARY

Closure was performed in three phases:

Phase One Closure consisted of removing the septic tank and washdown pad, associated contaminated soils, background and confirmation soil sampling (refer to Figures 4-1 and 4-2 and the Closure Certification Report for additional details).

Phase Two Closure consisted of removing additional soils from beneath and around the septic tank and washdown pad excavations (refer to Figure 4-3 and the Closure Certification Report for additional details).

Final Phase Three Closure consisted of removing additional soils from beneath the washdown pad excavation (refer to Figure 4-4 and the Closure Certification Report for additional details).

Post-Closure Monitoring consisted of installation of three new monitoring wells and quartelry ground water monitoring of seven on-site monitoring wells for one year. As clean closure was achieved, no other post-closure care was required, and post-closure certification was not required.

SECTION 5.0 RISK ASSESSMENT

Due to the absence of ground water contamination at YARL, a quantitative ground water contamination risk assessment was not required. However, quantitative calculations were completed for pesticide-specific soil action levels as measured concentrations in near surface soils beneath the waste units indicated a potential human health risk.

5.1 RISK ASSESSMENT APPROACH

The exposure model developed for YARL is based on standard pathways, media and exposure routes. Available soil and ground water quality data and applicable state and federal regulations were used to develop the model. Hazardous waste disposal activities have not impacted ground water, as demonstrated by two years of monitoring. Low-parts-per-billion detections of volatile organics and pesticides in three on-site wells have not been repeated in successive rounds of sampling. There is little or no statistical basis for assuming contamination at the site due to a single detection. Average concentrations fall well below drinking water standards. A standard exposure model development was used and since the site is surrounded by residential areas, the primary exposure in the absence of ground water contamination was through soil, with the primary route of exposure being consumption of soil by the most vulnerable population in a residential setting - generally assumed to be children.

Our characterization of the hydrogeology at YARL demonstrates that there is little or no likelihood of soil contamination reaching ground water. This assumption is based upon lack of contamination, geology, climate, the presence of caliche soil horizons and the physicochemical characteristics of the pesticide contaminants of concern. Therefore, application of ground water protection-based criteria (as provided under MTCA) for soil do not appear to be appropriate or feasible. Section 173-340-740 of MTCA regulations states soil cleanup levels must be established relative to ground water protection criteria, unless it can be demonstrated that soil contamination has little chance of impacting ground water. The Washington Department of Ecology considers residential site use and exposure to hazardous substances via soil ingestion to be the maximum exposure scenario when soil quality is the problem; therefore the exposure model for YARL assumes this exposure scenario to be the "worst case" approach as defined in the Closure Plan and Project Plan.

Based on the approved plans, achievement of source control through septic tank, washdown pad, drainfield and limited soil removal at the YARL RCRA facility will achieve "clean closure" if the confirmation samples display concentrations below proposed soil action levels. Guidance from appropriate EPA and Ecology regulations was used to generate the action level calculations (see below). These action levels were calculated for the YARL site based on a cumulative noncarcinogenic risk estimate of less than 1.0, based on daily intake and a lifetime incremental cancer risk of less than one in a million. Changing regulations and initial soil quality data required additional action level calculations and modifications of the original (i.e. in Project Plan) action levels. In addition, the action levels were compared to Washington State MTCA method B cleanup levels (soil cleanup in residential area - most stringent).

In summary, the exposure model identified the worst case scenario of potential exposure. The risk assessment assumed that the criteria was a total risk of no greater than 1 in a million for cancer, and that the action levels were based specifically on this worst case situation. The levels were based upon the most stringent standards available in addition to the health-based determination.

5.2 INDICATOR COMPOUNDS

Detailed calculations were based on MTCA (WAC 173-340) and EPA (Federal Register, 55 Fed. Reg. 30798, 27 July, 1990). The indicator compounds selected are DDTr (the combined total of 4,4' DDT, 4,4' DDD AND 4,4' DDE) and dieldrin, the most widespread and persistent pesticide residues at YARL that have exceeded action levels. Endosulfan (I and II) is also present, but at concentrations below calculated action levels. DDTr and dieldrin were chosen as indicator compounds due to their persistence and widespread occurrence and also because they have the lowest acceptable cleanup criteria. The proposed action level for dieldrin is 44 ppb, based on the most recent calculations, using EPA criteria. Under MTCA, the action level has been calculated at 63 ppb. The proposed action levels (830 ppb, EPA or 1,000 ppb, MTCA) for DDTr appear to still be valid. Therefore, based on our confirmation sampling data, none of these action levels was exceeded in the most recent rounds of sampling. Based on this information, additional soil cleanup should not be necessary at the YARL facility.

SECTION 6.0 CLOSURE CERTIFICATION

Closure certification was completed with the submittal fo the closure certification report and letter in November and December, 1991. The following information is paraphrased and/or excerpted from the Report.

6.1 CLEAN CLOSURE DEMONSTRATION

Clean closure, as used herein and in the RCRA closure plan, is defined as cleanup to a level of average soil concentrations less than the established health-based criteria. Clean closure has successfully been demonstrated at YARL, and is evidenced by the following:

1. The septic tank and its contents, the washdown pad and the drainfield were removed, achieving source control. The nature of the septic tank contents was determined through conventional waste profiling prior to shipment and final destruction at a hazardous waste facililty.

2. Approximately 40 cubic yards of contaminated soil containing pesticides above

proposed action levels have been removed from the former tank/pad area and disposed of at a licensed hazardous waste TSD facility.

3. Two background samples taken during the initial closure phase (tank/pad removal) have illustrated that low parts-per-billion levels of pesticide residues such as dieldrin and DDTr are to be expected in this area, due to historical, legal application of these pesticides totally unrelated to the former YARL septic disposal practices. The background concentrations are generally in the same order of magnitude as the proposed action levels.

4. Analysis of soil samples has not detected significant concentrations of PCBs, volatile organics, semi-volatile organics and metals.

5. Organophosphorus pesticides, identified in the tank contents, were not present in significant quantities in site soils.

6. Dieldrin and DDTr are the contaminants of concern due to their toxicity and because analytical results demonstrated that they were widespread and persistent at relatively high levels and have the lowest acceptable cleanup criteria. Ground water concentrations of these and other regulated pesticides did not exceed health-based criteria or action levels. Structures that showed contamination above action levels were removed. This applied to the septic tank, drainfield area and the washdown pad area.

7. Concentrations of DDTr and dieldrin were dramatically reduced through careful overexcavation and confirmed by resampling efforts. The removal of the source material was achieved conservatively, assuming that the average concentration of each side of the excavation was an appropriate standard, rather than the average for the entire site. The final concentrations were well below (some were non-detectable) the proposed action levels; one sample was just 2 parts per billion below the 44 ppb level and 3 others were non-detects. Soils in the vicinity of the washdown pad and septic tank were removed to the extent that no detections in excess of soil action criteria were allowed to remain. The average concentrations are all well below proposed action levels.

8. Finally, actual closure efforts went beyond the level defined above, in that for the sake of public health, clean closure was only assumed after <u>all</u>, not the average, concentrations above criteria were removed. Thus, the most conservative and strict interpretation of the intent of RCRA was used during closure at YARL.

6.2 COMPLIANCE SUMMARY

Following is a summary of the essential closure-related elements of 40 CFR 265, included as a reference and a checklist that demonstrates clean closure.

1. *265.112: Closure Plan* - Completed prior to initiating closure activities
2. *265.111 Closure Performance Standard*
   a) Minimizes the need for further maintenance - All waste disposal units removed
   b) Controls, minimizes or eliminates post-closure escape of hazardous waste - All hazardous materials and source areas exceeding criteria removed

3. *265.114 Disposal or decontamination of equipment, structures and soils* - Achieved in in three phases

4. *265.115 Certification of closure* - Previously submitted letter from Sweet-Edwards/Emcon

5. *265.116 Survey Plat* - Not required, as this is clean closure, i.e. no waste disposal units remain on-site, therefore there is nothing to survey.

SECTION 7.0 POST-CLOSURE MONITORING

Following phase one closure, post-closure monitoring (ground water monitoring) was performed quarterly, as per the approved plans.

7.1 GROUND WATER MONITORING SYSTEM

The ground water monitoring system consisted of the following:

One upgradient well, MW-D
One offgradient/upgradient well, MW-G
Four downgradient wells, MW-A, MW-B, MW-C, MW-F
One deep aquifer well, MW-E

Refer to Figure 4-1 for the locations of the monitoring wells. The upgradient, offgradient and downgradient classifications are relative to the former septic tank/drainfield system. All wells were installed in accordance with WAC 173-360 and will be abandoned in accordance with WAC 173-360-500.

7.2 GROUND WATER SAMPLING PROCEDURES

Sampling was performed as per the approved plans. Documentation of the sampling procedures are contained within the appendices of each individual quarterly monitoring report. Standard RCRA monitoring procedures were employed; water levels were measured first, followed by purging each well until indicator parameters stabilized, followed by collection (using a dedicated pump) of samples, filling volatiles containers first and nonvolatiles containers last and priority overnight shipment to the laboratory. Refer to Figure 7-1 for a schematic of the monitoring well construction and Figure 7-2 for a schematic of the dedicated pumps installed at YARL. Detailed well logs and as-builts are found in the August 29, 1990 Monitoring Well Report.

TABLE 7-1

GROUND WATER ANALYTICAL METHODS

PARAMETER	METHOD	NO. OF ANALYTES	TOTAL NO. OF ANALYSES *
TCL Metals	EPA 6010, 7000, 7470	24	65
Volatile Organics	EPA Method 8240	34	70
Organochlorine Pesticides	EPA Method 8080	19	63
Organophosphorus Pesticides	EPA Method 8140	11	63
Herbicides	EPA Method 8150	3	63

Notes: Totals include QA/QC duplicates. 70 volatile organic analyses due to trip blanks; 63 pesticide/herbicide analyses due to broken sample bottles and aborted analysis during final round of sampling.

7.3 QUARTERLY MONITORING

Five quarters of monitoring for one year (actually one year and two months) were performed to characterize ground water quality at YARL.

7.3.1 August, 1990

This sampling event included collection of quadruplicate samples from each of the seven wells (28 samples). There were no positive organic compound detections. Ground water level measurements were taken August 7 and September 4, 1990. Results of the first quarterly monitoring were reported October 10, 1990. The most significant quality control problem was with headspace in most of the volatile sample vials. A Henry's Law calculation/analysis determined that the average size of the bubbles (1/8") was not significant.

7.3.2 November, 1990

This sampling event included collection of seven samples plus one duplicate from the seven wells (8 samples). The following positive organic compound detections were reported:

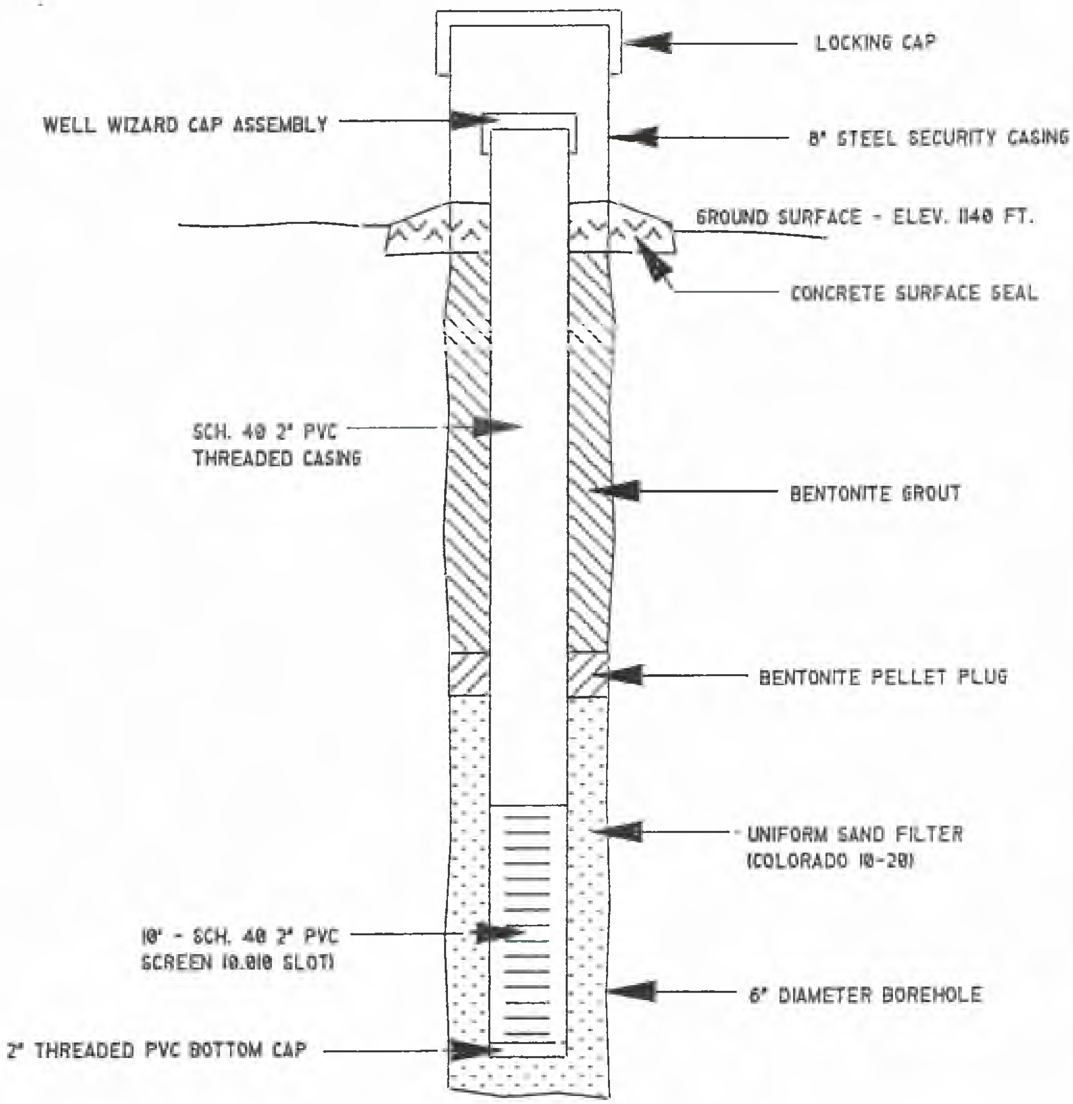
			Washington (WAC 173-200) Criteria
malathion	.23 ug/l	MW-B	---
heptachlor	.06 ug/l	MW-C	.02 ug/l
4,4' DDT	.11 ug/l	MW-C	0.3 ug/l (DDTr)
heptachlor epoxide	.10 ug/l	MW-E	.009 ug/l

These detections were not repeated in subsequent sampling rounds. Since they were below the most stringent water quality standards (Washington state), they are not considered significant. Ground water level measurements were taken October 22, November 14 and December 12, 1990. Results of the second quarterly monitoring were reported January 23, 1991.

7.3.3 February, 1991

This sampling event included collection of seven samples plus one duplicate from the seven wells (8 samples). There were no positive organic compound detections. Ground water levels were measured on January 3, February 20, March 13 and April 4, 1991. Results of the monitoring were reported on May 3, 1991.

7.3.4 May, 1991



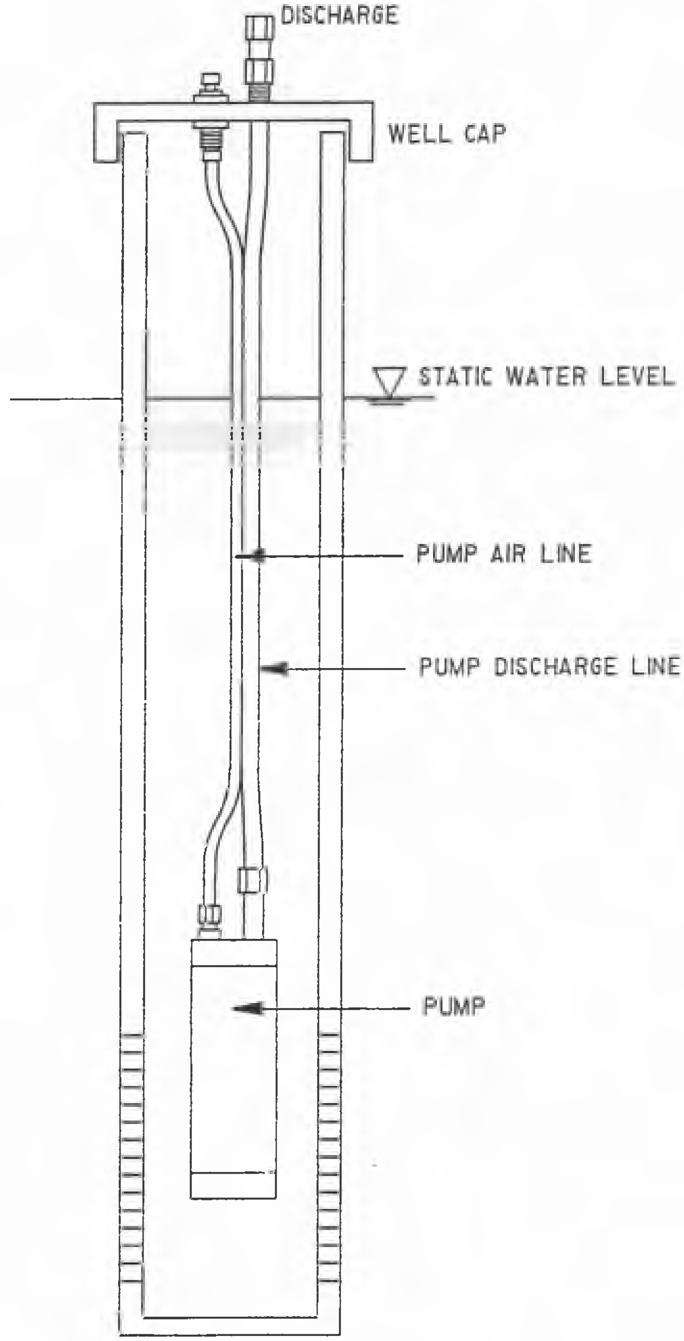
DRAWING NOT TO SCALE

HONG WEST & ASSOCIATES

YAKIMA AGRICULTURAL RESEARCH LABORATORY

MONITORING WELL SCHEMATIC

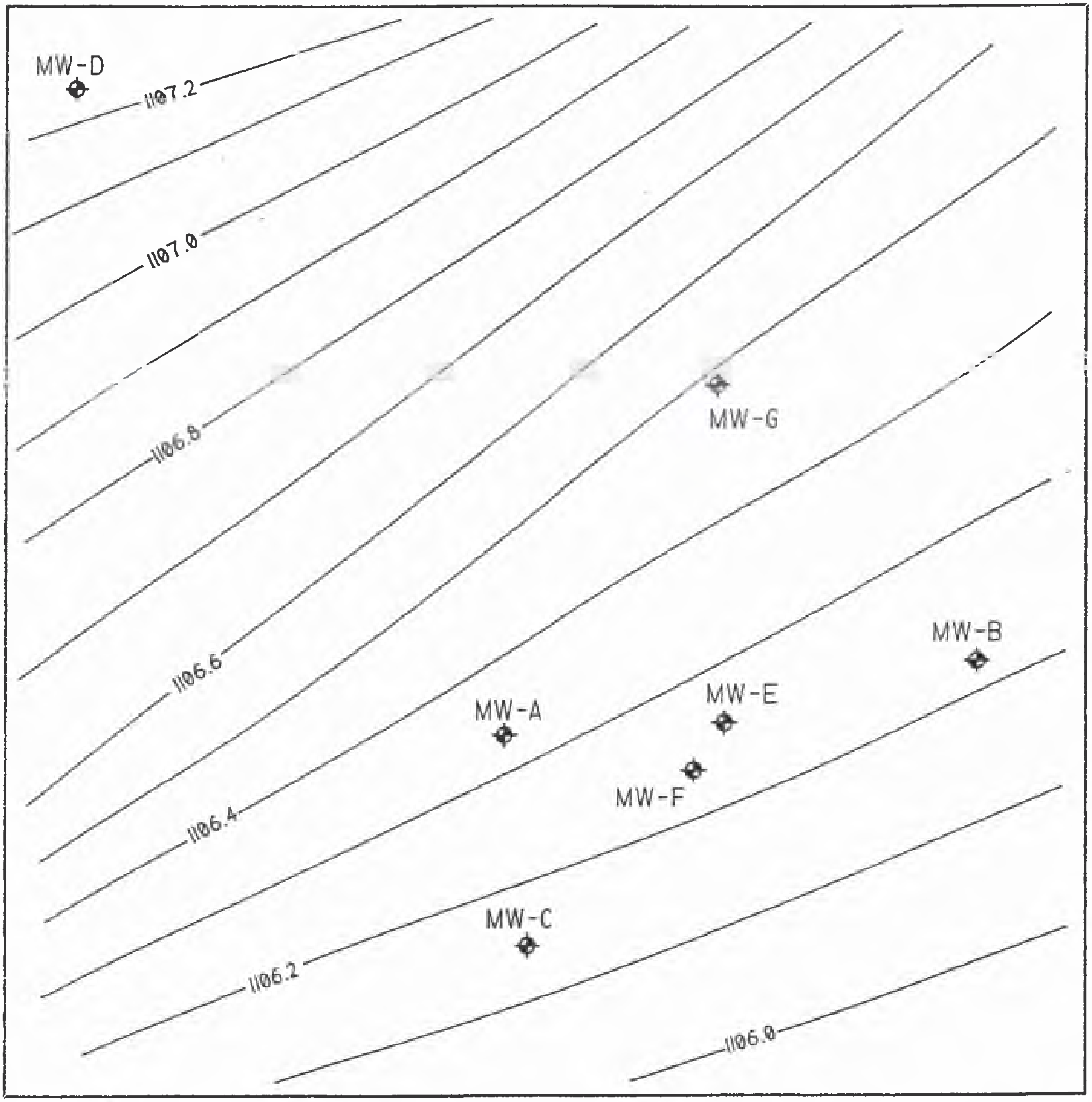
PROJECT NO. 90042	FIGURE NO. 7-1

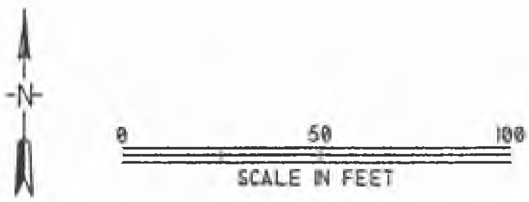


DRAWING NOT TO SCALE

Pump brand utilized is Well Wizard.

HONG WEST & ASSOCIATES	
YAKIMA AGRICULTURAL RESEARCH LABORATORY	
DEDICATED SAMPLING PUMP SCHEMATIC	
PROJECT NO. 90042	FIGURE NO. 7-2





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YAKIMA AGRICULTURAL RESEARCH LABORATORY

COMPOSITE WATER LEVEL CONTOUR MAP 1988-1991

PROJECT NO. 90042	FIGURE NO. 7-3

This sampling event included collection of seven samples plus one duplicate from the seven wells (8 samples). There were no positive organic compound detections. Ground water levels were measured on May 6, June 13 and July 16, 1991. Results of the monitoring were reported on July 30, 1991.

7.3.5 October, 1991

This sampling event included collection of seven samples plus one duplicate from the seven wells (8 samples). There were no positive organic compound detections. Ground water levels were measured on August 16 and October 1, Results of the monitoring were reported on November 1, 1991.

7.4 WELL ABANDONMENT

The seven monitoring wells at YARL are to be abandoned in a manner consistent with WAC 173-160-500, abandonment of Resource Protection Wells. The procedure is as follows:

1. Mix and pump (using tremmie below the water table) 10/11 lb/gal volclay bentonite slurry grout down each well casing, from bottom of well screen to ground surface.

2. Remove surface protective casing, protective bollard posts and surface concrete seal.

3. Regrade wellhead area level with surrounding area.

4. Report abandonment procedures to Department of Ecology, Central Region.

Well abandonment is scheduled for February, 1992, pending authorization and approval from USDA and applicable regulatory agencies.

SECTION 8.0 DATA EVALUATION

A QC review was conducted for the soil sampling data, focusing on background samples and on-site samples (on-site refers to the latest round of confirmation samples taken from the septic tank, washdown pad and drainfield). A statistical evaluation, using the protocol in Chapter 9 of SW-846, was performed for 21 samples. Refer to the Closure Certification Report for additional information on soil quality data.

No detailed QA/QC review was conducted for the ground water quality data, for three reasons:

1. The large number of samples and analytical parameters and the very small number of positive detections (4), which occurred during the second monitoring event.

2. The majority of the data reported by Biospherics, Inc. indicated acceptable blank, spike and surrogate results, thus reducing to insignificant the possibilities for false negatives.

3. Due to non-detects and similar indicator parameters recorded during sampling, there was no basis for comparing upgradient versus downgradient ground water quality.

In summary, no difference between upgradient and downgradient water quality was recorded at YARL. All of the constituents analyzed for were below detection limits or applicable water quality standards.

All of the data gaps referenced in the initial data gap report (refer to Section 1.4) were closed, with the exception of identification of unknown pesticides.

SECTION 9.0 CONCLUSIONS

With the exception of well abandonment, all on-site investigations, analyses and evaluations at the YARL facility are complete. HWA has completed all of the tasks of the clean closure investigation. The supervising engineer (David Aschom, P.E. of Sweet-Edwards/Emcon) has prepared and submitted a closure certification letter for submittal to U.S. EPA Region X. The following list of conclusions sums up the efforts to date at YARL:

1. The YARL facility operated a modified septic tank/drainfield system from approximately 1965 to 1985 and periodically discharged dilute waste pesticide solutions through this system.

2. USDA, the operator of YARL, accepted responsibility for environmental compliance at YARL, and selected clean closure under RCRA, 40 CFR 265 Subpart G as the best and most feasible approach to eliminate the threat to the environment posed by YARL.

3. YARL is located in an arid region, averaging approximately 7 inches of precipitation per year.

4. The YARL site is located over an unconfined aquifer, composed of unconsolidated to partially consolidated sand and gravel at approximately 35 feet. The thickness of the aquifer is at least 90 feet.

5. The YARL site is located in a discharge zone of the uppermost aquifer; there is an upward component to ground water flow at the site.

6. Ground water passes beneath the YARL site at an average rate of about 1 foot/day, at a gradient of .008 ft/ft, flowing generally toward the southeast.

7. Ground water quality, as measured on-site at YARL, is generally excellent.

8. Soil quality at YARL has been impacted two ways: 1) by historical, legal application of pesticides and 2) by releases from the former septic tank/washdown pad/drainfield system.

9. Health-based criteria were established for soil cleanup levels at YARL to reduce the acceptable level of risk based on the most conservative exposure scenario (future residential site usage).

10. Contaminated soil was removed sequentially surrounding the waste units until individual conentrations at each site sampled were below the proposed health-based criteria.

11. All contaminated materials were removed, transported and disposed of in accordance with applicable state and federal regulations and manifest documentation was provided.

12. All waste units, as defined in the approved closure plan and all contaminated soils, as defined by health-based criteria, have been removed from YARL.

13. Based on the above, YARL should be removed from the National Priorities List, following appropriate review and acceptance by EPA, Department of Ecology and the Public.

SECTION 10.0 REFERENCES

1. Driscoll, 1986; Groundwater and Wells, Johnson Division, St. Paul, Mn. 1089 pp

2. Foxworthy, 1962; Geology and Ground Water Resources of the Ahtanum Valley, Yakima County, Washington USGS Water Supply Paper 1598

3. Molenaar, Grimstad & Walters, 1980; Principal aquifers and well yields in Washington: Wash. Dept. of Ecology Geohydrologic Monograph 5

4. Molenaar, 1985; Water in the Lower Yakima River Basin, Washington. Wash. Dept. of Ecology Water Supply Bulletin 53

5. Mudorff, 1953; Availability of ground water to supplement surface water irrigation in Yakima River Basin, Washington. U.S.G.S. Open-File Report

6. Nob Hill Water District, file search, 1990

7. Pacific Northwest River Basins Commission, 1977; Yakima Basin Level B study of Water and Related Land Resources, Vancouver, Washington

8. Pearson, 1985; Hydrology of the Upper Yakima River Basin, Washington. Wash. Dept. of Ecology Water Supply Bulletin 52

9. Powers, J.P., 1981, Construction Dewatering, A Guide to Theory and Practice; John Wiley and Sons, New York, 484 p.

10. Sichart and Kyrieleis, Fundamentals of Groundwater, Berlin, 1930 in Driscoll, 1986; Groundwater and Wells.

11. U.S. Army Corp of Engineers, Seattle District, 1978; Yakima Valley Regional Water Management Study (Volume IV: Geology and Ground Water).

12. U.S. Department of Agriculture, 1958; Soil Survey of Yakima County, Washington. Soil Conservation Service series 1942

13. U.S. Weather Bureau, 1920-65; Climatological Data, Washington v. 24 No. 1-69

14. Washington Department of Ecology, Water Well Files and Water Rights Files

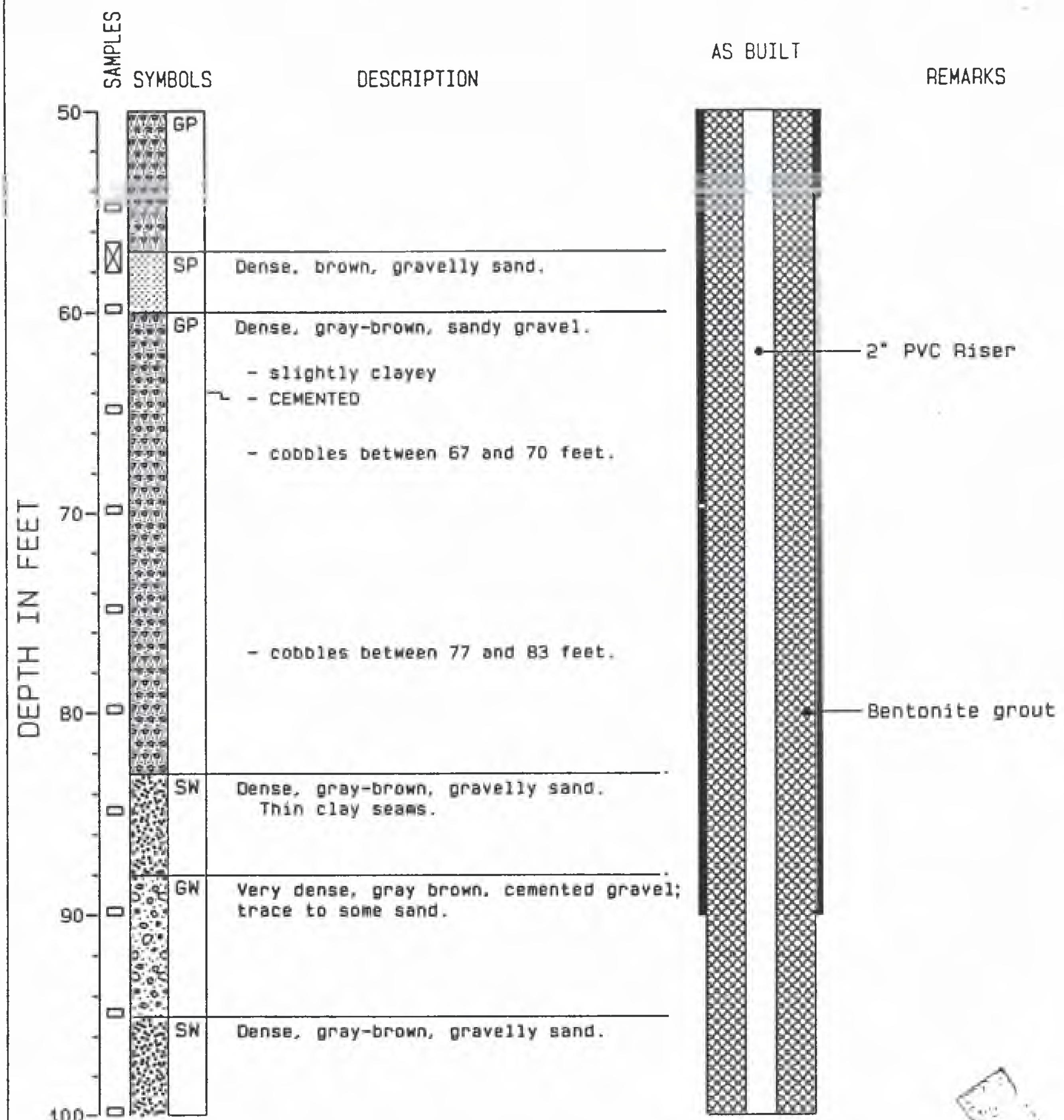
15. Washington Division of Natural Resources, Geologic Map of the Yakima 15' Quadrangle. GM-29 scale 1:62,500, by Bentley and Campbell, 1983.

APPENDIX

MONITORING WELL LOGS

DRAFT

HONG WEST & ASSOCIATES
WELL LOG

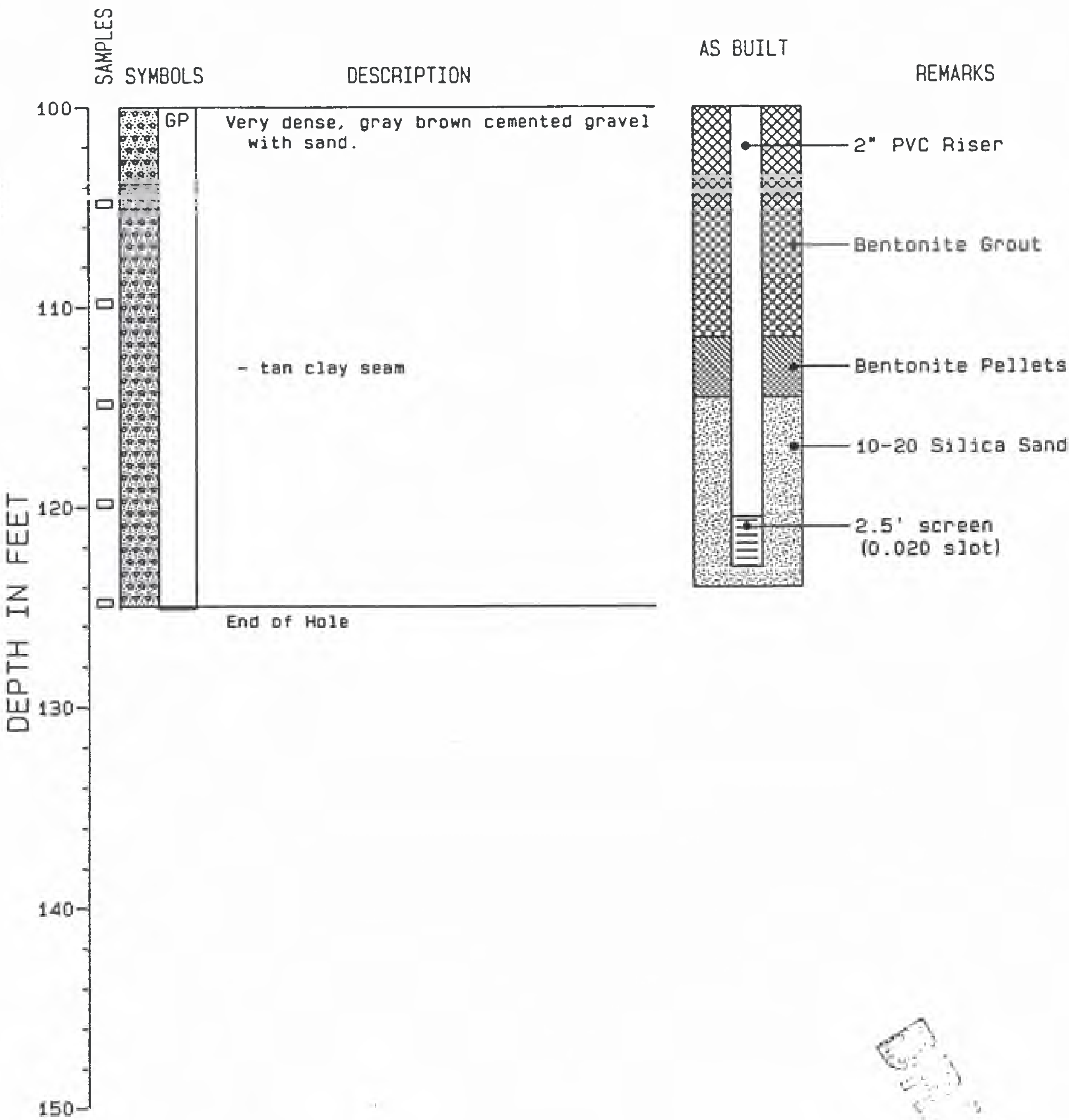


PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1141.03 ft.
TOP OF WELL CASING: 1143.52 ft.

WELL MW-E

PROJECT NUMBER: 90042

HONG WEST & ASSOCIATES
WELL LOG



PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1141.03 ft.
TOP OF WELL CASING: 1143.52 ft.

WELL MW-E

PROJECT NUMBER: 90042

HONG WEST & ASSOCIATES

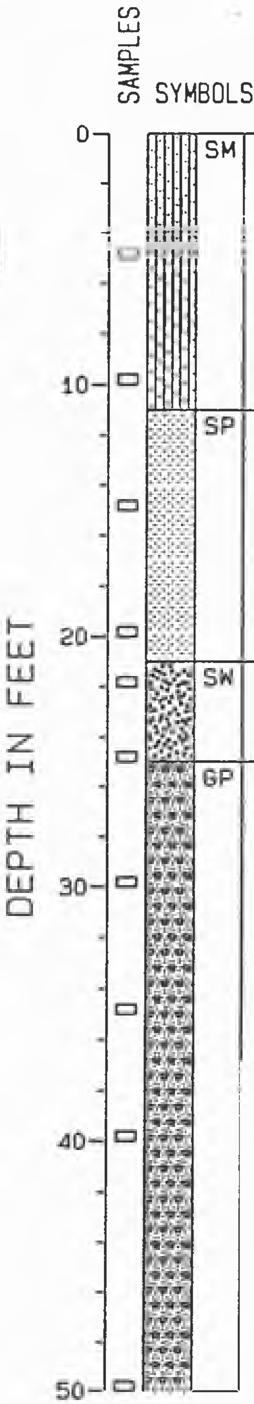
P.O. BOX 596, LYNNWOOD, WASHINGTON 98046, (206) 774-0106

WELL LOG

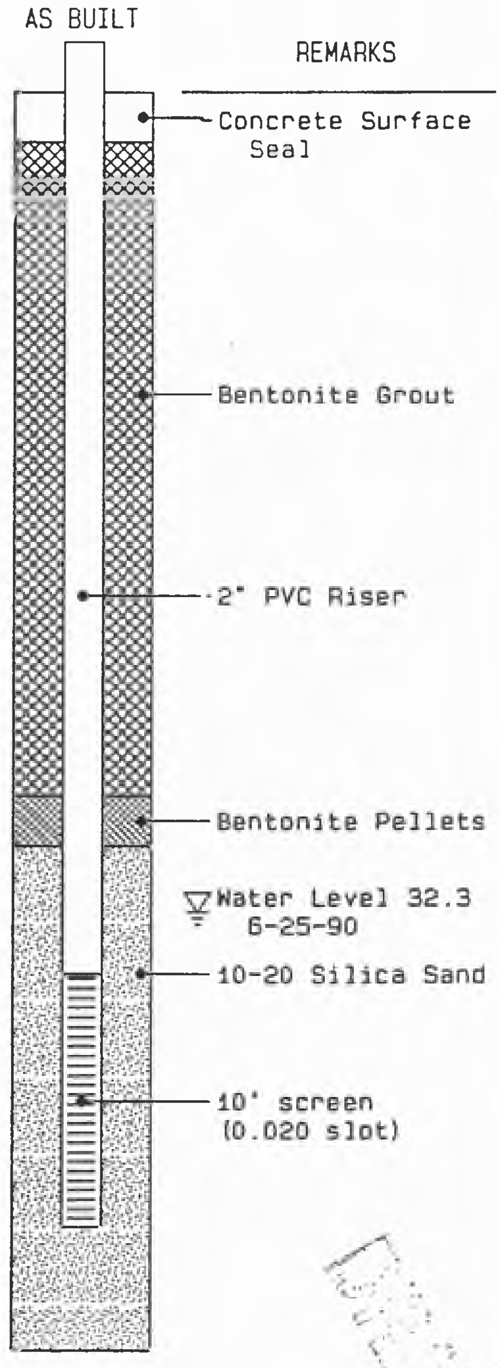
LOGGED BY: Dan Howard

DRILLING COMPANY: Ponderosa Drilling
DRILLING METHOD: Air Rotary - Tricone
SAMPLING METHOD: Grab Sample From Air Discharge Tube.

TOTAL DEPTH: 55 FEET
DATE STARTED: 6-22-90
DATE FINISHED: 6-22-90



SYMBOLS	DESCRIPTION
SM	Loose, brown fine sand and silt. Some silt/clay lumps.
SP	Loose, brown med. to coarse sands. Some gravels.
SW	Med. to very dense, gray to brown sand and gravel. Some cobbles and silt. Minor cementing.
GP	Med. dense to dense, gray to brown gravels; some sand. Minor cementing.



PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1141.28 ft.
TOP OF WELL CASING: 1144.18 ft.

WELL MW-F

PROJECT NUMBER: 90042

HONG WEST & ASSOCIATES
WELL LOG

DEPTH IN FEET	SAMPLES	SYMBOLS	DESCRIPTION	AS BUILT	REMARKS
50		GP	Very dense, gray to brown gravels. some sand and clay.		
			End Of Hole		
60					
70					
80					
90					
100					

PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1141.28 ft.
TOP OF WELL CASING: 1144.18 ft.

WELL MW-F

PROJECT NUMBER: 90042

HONG WEST & ASSOCIATES

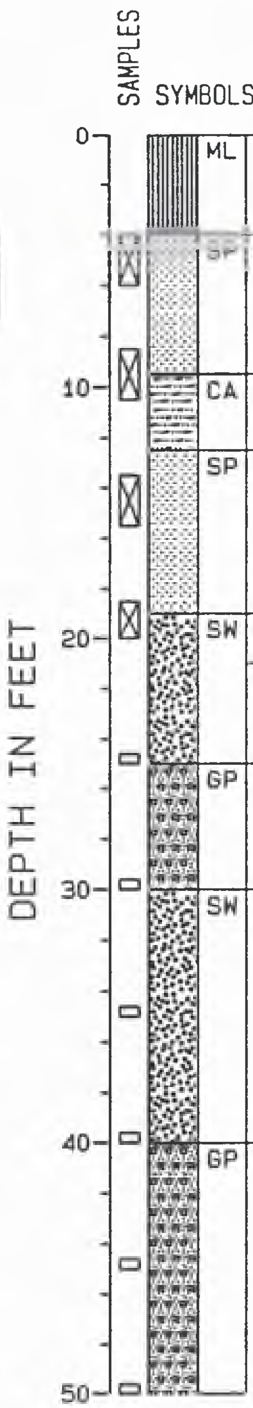
P.O. BOX 596, LYNNWOOD, WASHINGTON 98046, (206) 774-0106

WELL LOG

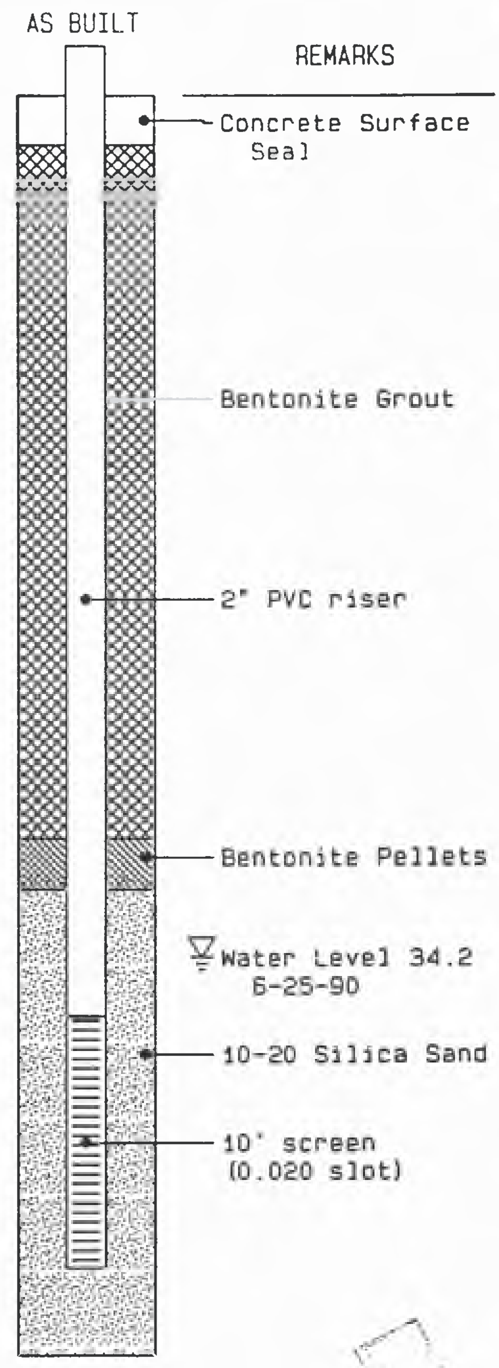
LOGGED BY: Larry West/Doug Geller

DRILLING COMPANY: Ponderosa Drilling
DRILLING METHOD: Hollow Stem Auger 0-21', Air Rotary 21-52
SAMPLING METHOD: Split Spoon. Grab Sample-Air Discharge.

TOTAL DEPTH: 52 FEET
DATE STARTED: 6-18-90
DATE FINISHED: 6-19-90



SYMBOLS	DESCRIPTION
ML	Loose, brown silt (fill) Damp. Some fine sand.
SP	Dense, brown/white sand.
CA	Caliche 9.5-12.5 feet.
SP	Dense, brown, damp, medium sand.
SW	Dense, brown gravelly Sand — Cobbles
GP	Med, Dense to Dense, Brown sandy gravel trace fine sand and silt; damp.
SW	Dense, brown gravelly sand
GP	Dense, gray brown cemented sandy gravel

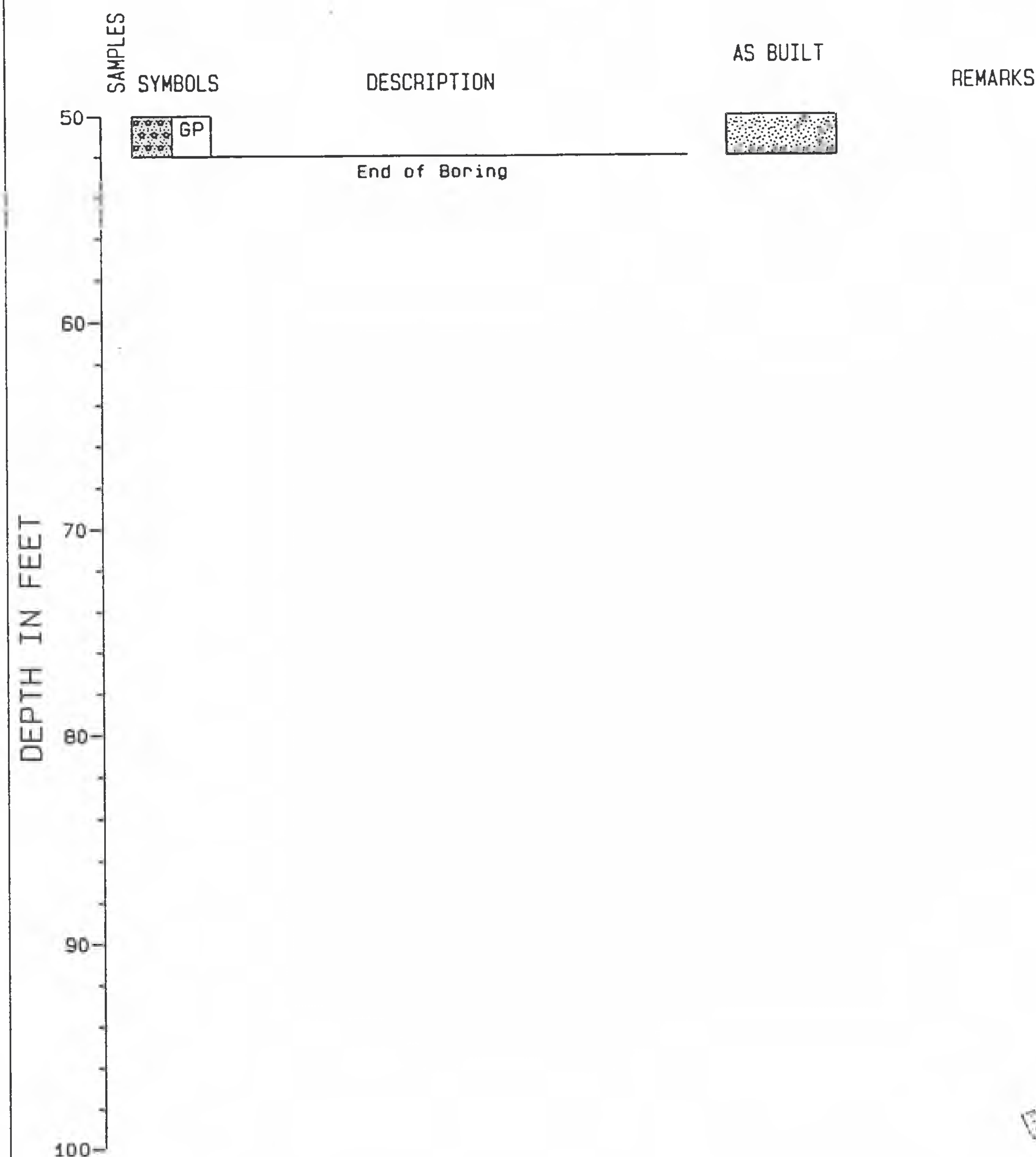


PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1142.43 ft.
TOP OF WELL CASING: 1144.99 ft.

WELL MW-G

PROJECT NUMBER: 90042

HONG WEST & ASSOCIATES
WELL LOG



PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1142.43 ft.
TOP OF WELL CASING: 1144.99 ft.

WELL MW-G

PROJECT NUMBER: 90042

PAGE: 2 OF 2

HONG WEST & ASSOCIATES

P.O. BOX 596, LYNNWOOD, WASHINGTON 98046, (206) 774-0106

WELL LOG

LOGGED BY: Steve Greene

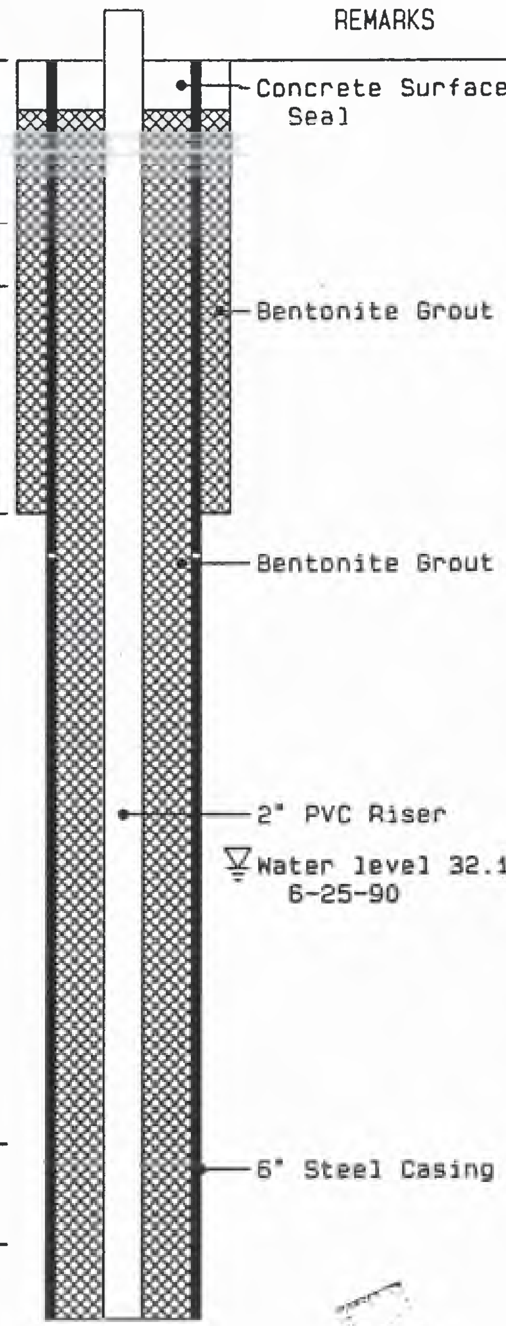
DRILLING COMPANY: Ponderosa Drilling
DRILLING METHOD: Air Rotary - Tricone
SAMPLING METHOD: Grab Sample From Air Discharge Tube.

TOTAL DEPTH: 124 FEET
DATE STARTED: 6-20-90
DATE FINISHED: 6-22-90

DEPTH IN FEET	SYMBOLS	DESCRIPTION
0	ML	Loose, brown fine sand and silt.
		- Med. stiff, brown sandy silt
	CA	- Caliche layers. Very Hard
10	SP	Med. dense, brown Med. fine sand. Trace gravel. Dry.
		- medium dense, gray. med.-fine sand.
20	GP	Med. dense, gray sandy gravel. gravels are subrounded Basalt and Andesite.
		- dense
		- cobbles between 27 to 29 feet.
30		
40		
	SW	Med. dense, gray gravelly sand.
50	GP	Med. dense, gray sandy gravel. Slightly silty.

AS BUILT

REMARKS



PROJECT: YARL
LOCATION: 3706 W. Nob Hill Rd., Yakima, WA
SURFACE ELEVATION: 1141.03 ft.
TOP OF WELL CASING: 1143.52 ft.

WELL MW-E

PROJECT NUMBER: 90042